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CIVIL ENGINEERING.

On the Motion of Water in Conduit Pipes; on Friction and Pressure in Pipes; and on Jets d'Eau. *By* M. D'AUBUISSON DE VOISINS, *Ingénieur en chef Directeur au Corps Royal des Mines, &c., &c.* *Translated by* T. HOWARD, *for the Civil Engineer and Architect's Journal.**

Continued from page 8.

Equation where Conduits are terminated by Adjutages.

12. We have hitherto considered conduits as entirely open at their further extremity, whereas they are generally terminated by nozzles or cocks, or have some kind of adjutage which contracts the opening, and makes the water issue forth with a velocity different from the uniform motion of the fluid in the pipe: consequently the equations (I. to XII.) based upon the supposition of identity of velocity, do not apply except under that condition. The first member of these equations, $H - \cdot 155v^2$, gives the portion of the head destroyed by the resistance of the conduit; which portion is the entire head H, minus that which remains to produce the velocity of discharge (2): if this velocity is called V, the first member of the equation will, in general, be $H - \cdot 155\,V^2$. The second member is the expression of the resistance of the sides (7), which is a function of the velocity in the conduit, or of v; v ought then to remain as it is in this member, which will not change in value.

13. In conduit pipes, even more, if possible, than in other cases of fluids with unbroken continuity of motion, the velocities, at particular points, are

* From the London Civil Engineer and Architect's Journal, for May, 1850.

in inverse ratio to their sections: so that if d be the diameter of an adjutage at its discharging orifice, m the coefficient for its particular contraction, D being invariably the diameter of the conduit, we have

$$V : v :: \pi' D^2 : \pi' m d^2; \text{ or}$$

$$V = v \frac{D^2}{md^2} = 1{\cdot}273 \frac{Q}{D^2} \times \frac{D^2}{md^2} = 1{\cdot}273 \frac{Q}{md^2}.$$

The equation for the movement then becomes

$$\left.\begin{array}{ll} \text{[In metres]} & H - {\cdot}08264 \dfrac{Q^2}{m^2 d^4} = {\cdot}002221 \dfrac{L}{D^5} (Q^2 + {\cdot}0432\, QD^2) \\ \text{[In feet]} & H - {\cdot}02519 \dfrac{Q^2}{m^2 d^4} = {\cdot}000677 \dfrac{L}{D^5} (Q^2 + {\cdot}14173\, QD^2) \end{array}\right\} \quad \text{(XVI.)}$$

Of the five quantities which this equation contains, four being given, we may by it obtain the value of the fifth.

It is required, for example, to determine the diameter necessary to give to a circular orifice in a thin plate, fitted to the end of a conduit of ·08 feet diameter, and 532 feet long, the quantity of water to be discharged per second being ·02 feet, and the head 4·5 feet. The above equation will give

$$d = \sqrt[4]{\frac{{\cdot}02519\, Q^2 D^5}{m^2 [\, HD^5 - {\cdot}000677 L(Q^2 + {\cdot}1417 QD^2)\,]}}.$$

Putting in the numerical values $m = {\cdot}62$, and reducing and extracting the fourth root, we have $d = {\cdot}0477$ feet.

14. For velocities above 2 feet per second, we have, (all being in feet,)

$$H - {\cdot}02519 \frac{Q^2}{m^2 d^4} = {\cdot}000711 \frac{LQ^2}{D^5}; \quad \text{(XVII.)}$$

$$Q = 37{\cdot}034 \sqrt{\frac{HD^5}{L + 35{\cdot}47 \dfrac{D^5}{m^2 d^4}}}; \text{ and} \quad \text{(XVIII.)}$$

$$D = {\cdot}235 \sqrt[5]{\frac{LQ^2}{H - {\cdot}02519 \dfrac{Q^2}{m^2 d^4}}}. \quad \text{(XIX.)}$$

Ex. 1.—To a conduit of the dimensions given below we will adapt a conical adjutage ·03 feet diameter: we require to know the quantity it will then discharge?

Here D = ·25 feet; L = 1450 feet; H = 5·32 feet; and for the coefficient for the convergence of the adjutage we take ·90. Consequently,

$$m^2 d^4 = {\cdot}0000006561; \text{ and } 35{\cdot}47 \frac{D^5}{m^2 d^4} = 52795.$$

$$\text{Then } Q = 37{\cdot}034 \sqrt{\frac{5{\cdot}32\ ({\cdot}25)^5}{1450 + 52795}} = {\cdot}01146 \text{ cub. feet.}$$

The complete equation (XVI.) would also give ·01146 cub. feet.

We would here remark that if, instead of an adjutage of ·03 feet diame-

ter, we put one of ·125 feet diameter, (half the diameter of the conduit,) the discharge will be . . ·06551 cub. feet.

With a diameter of ·1875 feet ($\frac{3}{4}$ diameter) . ·06881 "

Without any adjutage, we should have . ·06917 "

These results show that when the diameter of an adjutage is great compared with that of the conduit, (so as to be more than half thereof,) the discharge differs very little from that which we obtain by leaving the conduit entirely open.

In several of my experiments on the conduits of Toulouse, this fact was particularly observed; the difference in some cases was even much less than theory would give—it was imperceptible. For example, having at the end of a conduit of ·164 feet diameter, and 1391 feet long, successively fitted plates pierced with circular orifices, gradually decreasing in diameter, and under a constant head of 53·5 feet, we had the discharges here given. The diameter of the conduit being ·164 feet, the first is the result obtained without any adjutage. We observe that the results of calculation approach so much the nearer those of experiment, as the velocity of the water in the conduit becomes less.

Diameter of Orifice.	Discharge according to	
	Calculation.	Experiment.
Feet.	Cubic Feet.	Cubic Feet.
·164	·07558	·06074
·115	·07417	·06074
·098	·07311	·06074
·066	.06463	·05080
·049	·05192	·04697
·033	·02967	·02896

Ex. 2.—Required the diameter of a conduit 2736 feet long, and from which, with a head of 21·3 feet, we wish to obtain ·4 cubic feet of water per second, by several orifices placed near each other, and which taken together are equal in area to one circular orifice ·13 feet diameter; the coefficient of contraction in this case being taken as ·85?

We have $m^2d^4 = ·000206346$; $·02519 \frac{Q^2}{m^2d^4} = 19·547$; and consequently

$$D = ·235 \sqrt[5]{\frac{2736\ (·4)^2}{21·3 - 19·547}} = ·641 \text{ feet.}$$

ART. II.—CONDUITS WITH BENDS AND CONTRACTIONS.

Three kinds of Resistance in Conduit Pipes.

15. We have been hitherto considering conduits as rectilinear, and of equal section throughout their whole length; but they are generally formed with angles or bends, and occasionally have parts of a diminished section, either over a very small extent, (forming, as it were, an annular contraction,) or else through a considerable length. Water moving in such conduits, on arriving at the bends, is compelled to change its direction. In so doing it loses part of its velocity: the resistance which causes the loss is as a force opposed to the motive power or the original head; it destroys a part thereof.

At contractions, again, the fluid experiences another resistance, having there to pass through a narrower section, it requires to have a greater velocity; to obtain this a new effort is necessary, and the consequence is another diminution of the total head.

Thus water, in its motion in pipes, meets, or may meet, with three kinds of resistance—that due to the effect of the sides, and which is by far the most considerable; that which arises from bends, and that from contractions. The forces or portions of the head employed to overcome these lessen the total head, and it is only by reason of the remaining part that the efflux takes place; this portion is the height due to the velocity of discharge.

We have treated in detail the resistance of the sides (4—8); we shall now examine the other two.

The Resistance of Bends and Angles.

16. Every moving body, which after having followed a certain direction suddenly changes therefrom, loses a portion of its velocity, represented by the versed sine of the angle formed by the two directions. If it moves in a curved line, it is continually changing its direction; but the loss of velocity at each change is only an infinitely small one of the second order; and consequently, although the number of losses be infinite, the total loss will be only an infinitely small one of the first order, or as nothing: in other words, every moving body which arrives tangentially at a curve, and follows it for some length, possesses on quitting it the same velocity it had on its arrival. It follows, that if a bend in a conduit be well formed, and the fluid therein should exactly follow the curve, it would suffer no resistance or loss of velocity.

But this is not the case, the molecules composing the fluid current being independent of each other, while those which are in contact with the sides would follow the curvature, the others, being directed against the sides, will be reflected by them, or by the intervening particles, at an angle which is sometimes very considerable. For example, the central fillet *a*C has a tendency to strike the side ACB at C, and from thence to be reflected in the direction C*b*. The mutual action of the particles on one another will produce, in the whole, a loss of velocity; it will be, generally, less than that of the central stream taken alone, but always greater than that of the current bordering on the sides.

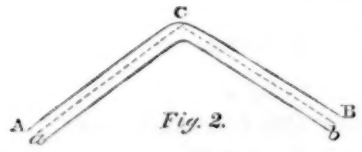


Fig. 2.

This diminution of velocity, and consequently of discharge, although certain, will yet be very slight. Thus, Bossut, with a pipe of 1·06 inch diameter, and 53¼ feet long, laid horizontally in a straight line, and with a head of 1·07 feet, obtained a discharge of ·7360 cubic feet per minute; then having bent it in a serpentine form, so as to have six well rounded curves, all else remaining the same, he obtained ·7205 cubic feet per minute.

We may, however, by multiplying and increasing the acuteness of the bends, render the diminution of discharge very considerable. Rennie, with a lead pipe 15 feet long, ½-inch diameter, fitted horizontally to a reservoir under a head of 4 feet, obtained a discharge of ·419 cubic feet per minute; then having given the same pipe fifteen semicircular bends, of 3¼

inches radius, and again fitted it to the reservoir, the discharge was not more than ·370 cubic feet, so that the fifteen bends reduced the discharge in the ratio of 100 to 89; with a quadruple head, the reduction was in the ratio of 100 to 88.

17. With regard to the laws regulating the resistance of bends, and to its amount, we are indebted to Dubuat for the first well-observed facts. He has taken various pipes, at first rectilinear, and measured the head necessary to obtain from them a certain volume of water in a certain time; he has then bent them in different forms, and in such a manner that the central current had a tendency to be reflected at angles of determined number and acuteness, and again examined the head with which they discharged an equal volume of water in an equal time. The difference between the two heads for the same pipe, at one time rectilinear and at another bent, was evidently the head due to the bends, and consequently the measure of their resistance. The principal of twenty-five experiments which he has thus made are given in the following table:

PIPE.			Velocity per Second.	Resistance due to the Bends.	Coefficient Deduced.
Diameter.	Length.	Angles. Number & Value.			
Inches.	Feet.		Feet.	Feet.	
1·07	10·39	1 of 36°	7·55	·067	·0034
1·07	10·39	2 of 36	7·55	·133	·0034
1·07	10·39	3 of 36	7·55	·221	·0037
1·07	10·39	4 of 24·57	7·55	·133	·0034
1·07	10·39	10 of 36	6·36	·524	·0037
1·07	12·40	4 of 36	5·16	·146	·0039
1·07	12·40	4 of 36	2·60	·036	·0039
1·07	65·46	4 of 36	2·54	·035	·0039
2·13	22·66	4 of 36	7·66	·257	·0030
2·13	22·66	4 of 36	5·22	·118	·0031
2·13	22·66	6 of 24·57 5 of 36 1 of 56·23	7·66	·767	·0038

Dubuat concludes from his experiments, that the resistance arising from bends is proportional to the square of the velocity of the fluid, to the number of angles of reflexion, and to the square of their sines.

In this hypothesis the coefficient varies but little, and its mean value is ·0037. So that if v be the velocity, n, n', &c. the number of angles of reflexion of equal measure, i, i', &c. the respective measures of the angles, the resistance will be

$$\cdot 0037\, v^2\, (n \sin^2 i + n' \sin^2 i' + \ldots\ldots\ldots\ldots);$$

or in function of Q, and taking s for the sum of the squares of all the sines, $\cdot 0061 \dfrac{Q^2}{D^4} \times s^2$.

18. In the application of this formula to any given conduit, we must determine the number and value of the angles of reflexion for each bend.

Now a simple diagram shows, 1st, that in a pipe bent to an arc of a circle, (and no other curves need be admitted in practice,) half the diameter of the pipe divided by the radius of the arc will give the versed sine of the angle of reflexion, and we may consequently get its cosine and value in degrees; 2dly, that the number of degrees in the arc, (*i. e.* the supplement of the angle of the curve,) divided by twice the angle of reflexion, will indicate the number of angles.

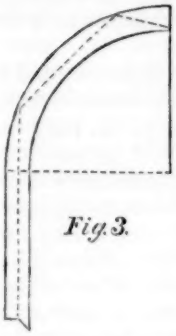


Fig. 3.

Let us, for example, take a conduit pipe ·82 feet diameter, conveying 1·76 cubic feet of water per second, and which presents a bend of 95°, the radius of the curve being 6·89 feet: what will be the resistance occasioned by this bend?

According to the rule laid down, the versed sine of the angle of reflexion will be ·0595 ($= \frac{\cdot 41}{6 \cdot 89}$), and its cosine ·9405 ($= 1 - \cdot 0591$), the cosine of an angle of 19° 52′; this is the angle of reflexion. The arc of curvature 85° ($= 180° - 95°$) divided by 39·73°, (twice the angle of reflexion,) will give their number; this we shall take as 3, the quotient being 2·14. The sine of 19° 52′ is ·3398, and its square ·1155; the resistance sought for will therefore be

$$\cdot 00608 \frac{(1 \cdot 76)^2}{(\cdot 82)^4} \times 3 \times \cdot 1155 = \cdot 0144 \text{ feet;}$$

a quantity extremely small, although the curve was tolerably acute and the velocity considerable. For the pipe with fifteen bends, in Rennie's experiment, the above method of calculation would give a resistance of ·633 feet; the experiment itself, as we shall shortly see, gave 1·16 feet, which would raise the coefficient of Dubuat from ·00608 to ·01113. But such a case as this seldom occurs in practice; nor does the value of the resistance, even if we double the coefficient, often amount to an inch loss of head.

We may neglect account of the value of this resistance in curves of great radius; the angles of reflexion, it is true, will be greater, but not so strong; and the sum of the squares of the sines, and consequently the resistance, will be less.

19. If the effect of well curved bends is imperceptible, it is not so with angles, properly so called. An experiment of Venturi shows their influence; this *savan* had three tubes made; 1·25 feet in length, and 1·3 inch diameter; one was rectilinear, the second had a bend of 90° well curved, and the third had an acute angle, also of 90°; under a head of 2·88 feet they filled a vessel containing 4·84 cubic feet respectively in 45″, 50″, and 70″. The bad effect of angles is shown still more plainly in the experiments of Rennie; with his pipe 15 feet long, ½-inch diameter, and with a head of 4 feet, he obtained, per minute, a discharge

With the rectilinear pipe . .	·419	cubic feet,
With the fifteen semicircular bends .	·370	"
With 1 right angle . . .	·333	"
With 24 right angles . . .	·153	"

so that one angle of 90° reduced the discharge more than 15 considerable

bends. This fact alone shows with what care all angles should be avoided in the establishment of conduit pipes.

In seeking the heads which made the three pipes with bends or angles give a discharge (.419 cubic feet) equal to that which was obtained when there was neither angle nor bend, we find them respectively 5·15, 6·33, and 30·52 feet. Deducting 4 feet, there remains for the resistance arising from the bends and angles (17) 1·15, 2·33, and 26·54 feet. From which we conclude that the resistance from a single angle of 90° was more than double that of fifteen bends; and that of twenty-four angles was only 11·4 times greater than that of a single one. This last result also shows that the resistance of angles and bends is not proportional to their number, as Dubuat had remarked. I had also observed a like want of proportion in my *Experiments on the Motion of Air in Conduit Pipes* ('Annales des Mines,' 1828, p. 453).

Resistance arising from Contractions.

20. Contractions, of which we are about to treat, are occasioned by a diminution of the section of the conduit for a very short length.

That we may give an exact idea of the resistance they offer to the motion, let us suppose a conduit in which, perpendicular to its axis, we have placed a diaphragm or thin partition pierced with an orifice. The stream, on arriving at this point, will contract and reduce itself to the size of the aperture, taking a greater velocity in proportion as the section is smaller; and this velocity will always be greater than it would have been in this part of the conduit without the partition. The force necessarry to produce the extra velocity, the direction of the motion remaining the same, will evidently be due to the resistance offered by the contraction.

Let B be the diameter of the orifice, m its coefficient for contraction. The velocity through this point requiring to be greater than in the conduit, and following the inverse ratio of the sections, will be then expressed by $\cdot 0155 v^2 \frac{D^4}{m^2 B^4}$. The excesses of force, or loss of head arising from the contraction, will therefore be

$$\cdot 0155 v^2 \left(\frac{D^4}{m^2 B^4} - 1 \right) = \cdot 0155 v^2 D^4 \left(\frac{1}{m^2 B^4} - \frac{1}{D^4} \right).$$

In terms of the discharge, this resistance will be expressed by

$$\cdot 02519\, Q^2 \left(\frac{1}{m^2 B^4} - \frac{1}{D^4} \right).$$

M. Navier, considering that the stream, on passing out of the contraction, immediately resumes the velocity proper to the conduit, instead of the difference between the squares of the two terms, $\frac{1}{mB^2}$ and $\frac{1}{D^2}$, takes the square of their difference, $\left(\frac{1}{mB^2} - \frac{1}{D^2} \right)^2$. But as this opinion is contrary to fact, as the experiments given in the next section will show, we must be careful in adopting a result founded on false premises.

It is but seldom, however, that we shall have to make use of the above formula, for in a conduit pipe there ought not to be any sensible contrac-

tion; should one accidentally be found, this formula will serve to give us the value of its resistance. It will generally be slight; in some experiments made with sluice valves fixed in the conduits of Toulouse, I found, after diminishing the section of one of them by $\frac{94}{100}$, that the discharge was only reduced $\frac{1}{100}$.

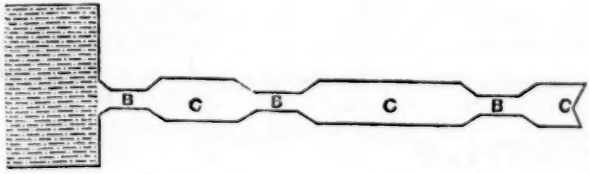
21. If, in the same conduit, below the first contraction there be a second, a third, &c., the resistance from each may be determined by the above formula, and their sum taken.

But, in order that these resistances may be thus added, they must be independent of each other: that is to say, the fluid, after passing through the first contraction, must have recovered the general velocity of the conduit before reaching the second. If it were not so, the fluid stream, after leaving the first contraction, would preserve entirely, or in part, the excess of velocity which it had acquired in order to pass through; and a less effort would be necessary for the second, and less in proportion as the distance between the contractions was smaller.

Eytelwein has made many experiments which fully demonstrate this fact. He took tubes 1·03 inch in diameter, at either end of which was a copper plate pierced with an orifice ·51 inch diameter; their length, or distance between the orifices, being given in the first column of the accompanying table. They were fitted horizontally to a reservoir, and the discharge made by each ascertained; this discharge, as compared with the theoretic discharge, which is represented by unity, is contained in the second column: it goes on gradually diminishing, and consequently indicating the resistance increasing, in proportion as the distance between the two orifices is greater. Eytelwein again fixed in a tube 1·03 inch diameter, four thin plates, each pierced with an orifice of ·256 inch diameter, and at a distance of ·256 inch from each other; the discharge was then ·622. When, however, the plates were placed at the distance of 1·03 feet from each other, the discharge was not more than ·0331.

Distance.	Discharge.
Feet.	
·023	·626
·043	·622
·085	·614
·171	·568
·260	·509
·430	·487
1·030	·481
2·060	·478

22. The observations we have made respecting contractions caused by thin plates pierced with orifices, apply equally to those which would be produced by very short tubes of a diameter smaller than that of the conduit. I cite the 24th Experiment of Venturi. This eminent philosopher, with great judgement, arranged his apparatus to consist of two sorts of



tubes alternately; the one B B were ·148 feet long, and $\frac{4}{8}$-inch diameter; the other C C, were 1·9 inches diameter, and their length sometimes ·289 feet, and sometimes ·564 feet. He at first made use of a single tube, C;

then of two, of three, of four, and lastly of five: he successively applied these various combinations to a reservoir, using a constant head of 2·89 feet, and the following are some of the discharges obtained:—

With a single tube, B . . .	·0444	cub. feet.
With a tube, C, added . .	·0329	"
With three tubes, C . . .	·0252	"
With five tubes, C . . .	·0202	"

I have attempted to compare these results with those by the methods of calculation I have given: the differences have been sometimes great, sometimes inconsiderable; thus, for the last case I have had ·0185 cubic feet.

23. Notwithstanding the great irregularities which these results present, they are well worthy attention, and principally on account of the very striking manner in which they show the effect produced by enlargements in a pipe; an effect, carried above a certain limit, altogether as prejudicial as that of contractions.

Venturi's entire apparatus, which was 3·2 feet long, may be considered as a pipe $\frac{4}{5}$-inch diameter, having the five enlargements C. It furnished, as we have seen, a discharge of ·0202 cub. feet. He afterwards, with a tube of the same length, but of the uniform diameter of $\frac{4}{5}$-inch, obtained ·0327 cub. feet. The enlargements thus diminishing the discharge in the ratio of 100 to 62.

24. There is yet one other contraction that ought to be considered—that experienced by the fluid stream on its entry into a pipe of less diameter than that which immediately precedes it. The resistance arising from this contraction will evidently be the same as if, at the entry of the pipe, we had placed a plate pierced with an orifice of which the section should be to that of the pipe as m to 1, (m being the coefficient belonging to the contraction,) and its expression will then be

$$\cdot 02519 \frac{Q^2}{D^4} \left(\frac{1}{m^2} - 1 \right);$$

This is a special case of the general formula (20), where B = D.

The value of m can only be approximatively. For a very short pipe, as for cylindrical adjutages, it will be ·82. But in pipes, properly so called, it approaches nearer to 1; and more so in proportion to the length of the pipe, and even, according to M. Prony, as the diameter is greater; so that in large conduits, the effect of this contraction is very small. It is still further reduced by connecting pipes of two diameters by a conical length gradually diminishing from one to the other.

Lastly, as we have remarked (5), the effect of the contraction at the head of a pipe is implicitly comprised in the values of the coefficients of the fundamental equation; and its effect at the entry of a pipe which branches from a larger conduit, will be comprised in the determination of the head of such branch, so that we need not in any case make calculation of it.

Observations on the Practical Application of the Formulæ.

25. The coefficients of the formulæ which we have given, especially those concerning the principal resistance—that due to the friction against the interior of the pipe—have been determined by experiments made chiefly on pipes of small diameter and of no great length (5); they have

been generally well-bored pipes, well joined, and free from incrustations. But can such formulæ be safely applied, without modification, to conduits of a different description—namely, to those used in large distributions of water? This is a question which we must now examine.

The pipes of which conduits are formed are almost always more or less imperfect, from the effect of the mould, or in casting; their section is no longer exactly circular, and consequently, *cæteris paribus*, it is smaller than it ought to be. Their interior surface presents inequalities which retard the motion. When joined, the axis of the whole is not always a line without rebatement; the interior is not a perfectly cylindrical surface; the edges of some of the pipes project, and the currents reaching these points are arrested, divided, and sometimes reflected back again; thus arise eddies in the movement, loss of motive force, and consequently a diminution of the discharge. Even when the pipes are well cast, so that the channel is very regular, there will be, nevertheless, at each joint, a little annular hollow, or a break of continuity, which will produce, to a certain extent, the effect of projections; and which, repeated at every joint in a long conduit, cannot but give rise to a perceptible reduction in the discharge. M. Gueymard, *ingénieur des mines*, has rightly insisted on this cause of reduction, and has endeavored successfully to obviate its effects in the establishment of the fountains at Grenoble.

Moreover, when the conduits are sinuous in their vertical planes, (as is generally the case,) if there are no vents at the summits of the highest parts, the air which the water carries with it, and which is disengaged in a greater or less quantity, rises into these elevated parts, and being there collected produces the effect of contractions, the bad effects of which we have already seen. The cleanest waters, in appearance, always carry with them foreign bodies, and especially extremely fine earthy particles, which are deposited in parts of the pipe, and in time contracting the section again diminish the discharge. I do not here speak of calcareous and siliceous matter, which, although held in solution in the water, become precipitated on the interior of the pipes, lining them with a stony crust, and, gradually increasing in thickness, would end by stopping them altogether, if not removed in time; this evil is peculiar only to certain localities. It is the same with regard to ferruginous deposits, which are made in a tubercular form in the conduits of Grenoble, and which, continually increasing in number and size, diminish the discharge to such a degree that, in eight years, it has been reduced more than one-half. The aërated water, running in pipes, likewise attacks the material, and forms a hydrate of iron, which is deposited in long nipples parallel to the direction of the current, and in greatest quantity on the lower part; underneath these, the iron is as it were corroded nearly to $\frac{1}{10}$th of an inch. ('Annales des Mines,' 1834, p. 203, *et seq.)*

Setting aside these local circumstances, it often happens that in experiments made on conduits apparently in a sound state, the discharge has been found to be less, by a quarter or a third, than that indicated by the formulæ; it is scarcely ever equal to it, I have quoted many of these experiments in my 'History of the Formation of the Fountains at Toulouse.' In consequence of these ascertained facts, the hydraulic engineers of Paris, when making use of the formulæ of discharge, diminish by one-third the

value of the numeric coefficients. I have adopted an analogous method, by augmenting by one-half the quantity of water which should determine the size of the conduit. It is, in my opinion, with such latitude that an engineer charged with the establishment of a plan for a large distribution of water, ought to employ the formulæ which we have set forth; he will then avoid the disappointments which would often occur if he uniformly adhered to results given by conduits made with a precision which can seldom belong to his own.

To be Continued.

Extracts from the Report of Prof. Alex. D. Bache, *Superintendent of the Coast Survey, showing the Progress of that Work for the year ending November*, 1849.

Mount Independence,
Near Portland, Maine, October, 1849.

Sir: In compliance with the regulations of the Treasury Department for the Coast Survey, I have the honor to submit to you my report of the progress of the work during the past year, to be laid before the President and Congress.

The reports of the assistants enable me to state the progress of the survey up to the month of October, and in some cases to November. The entire season's work of the parties in North Carolina, and the sections south of it, are thus included; while in part of the eastern sections, and as far south as Maryland and Virginia, the parties are still in the field. Some part of the operations of the survey, including field and office work, has been carried on in every State on the Atlantic coast and Gulf of Mexico; and a beginning has been made on the western coast. The period embraced in the report is in part included in the past, and in part in the present fiscal year.

The report contains:—1. A general statement of the progress of the coast survey, and of the publication of its results. 2. A separate summary of the progress during the past year. 3. The work proposed for the next *fiscal year*, with the estimated cost. 4. A more detailed account of the several operations in each section of the survey, under the different officers, with a notice of the results obtained. 5. An account of the office work for the year. 6. An appendix, containing tables of occupation of parties and results, and reports from the assistants on matters of interest to navigation, lists of maps published, and the like. The sketches appended to it are of two different classes: the first illustrating the progress of the several operations in each section of the coast, and the second, preliminary charts or sketches of important localities examined within the past year. A table indicates briefly the contents of each separate paper in the appendix, and of each sketch. The sketches illustrating the progress of the work are as follows: in section 1, sketch A; section 2, sketch B; section 3, sketch C, and C No. 2; section 4, sketch D; section 5, sketch E, and E *bis;* section 6, sketch F; section 7, sketch G; section 8, sketch H; section 9, sketch I. The preliminary charts are: B No. 2, Buttermilk

Channel, New York harbor; D No. 3, Hatteras Cove; D No. 4, Hatteras Inlet; E No. 2, Bull's Bay, near Charleston. There are, besides, two sheets of diagrams, H *bis* and *tris*.

The operations of the survey are now generally understood, but it is not so generally known that the scientific parts of the work, which give it its great value—its essential value—are not the expensive parts, but that those most eminently practical are the most costly ones. In realizing the idea of Jefferson and Gallatin of a geodetic survey of the coast of the United States, the difference of cost between it and a series of combined nautical and topographical surveys, conducted on equally economical principles, is unimportant, while the difference of value is very considerable.

The capacity of the geodetic method of survey for rapid progress is very great wherever the country is at all favorable to it. I have visited parts of the coast of fifteen of the nineteen States on the Atlantic and Gulf of Mexico, and have a more or less minute acquaintance with the character of most of the other parts of the coast, through the operations of the survey and the reports of the assistants. In nearly the whole extent the facilities for the application of the geodetic method are remarkable. On the coast of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and a part of New Jersey, are lofty hills, rising in some cases to mountains, just such as invite triangulation. On the coast of Connecticut, New York, part of New Jersey, North Carolina, Florida, and Mississippi, there are wide sounds between the main shore and the ocean beaches, which are particularly favorable for the work. Off the coast of Massachusetts, Florida, Mississippi, and Louisiana, there are numerous islands at distances from the main which exactly adapt them to a continuous chain of triangles connecting them with the shore. Indenting the coast of Maine, Massachusetts, New York, New Jersey, Delaware, Maryland, Virginia, Alabama, and Texas, are large bays, across which the triangle sides pass unobstructed. Even where the sounds narrow down, or the islands lie close to the shore, as in parts of New Jersey, Maryland, North and South Carolina, Florida, and Texas, though the triangles are shorn of their dimensions, their symmetry is still preserved, the characteristic accuracy of the system in its distances and directions remains, and the work is readily executed and progress still rapid. The prairies of the coast of Texas afford great facilities for any scheme of triangulation. This reduces the difficult parts of the coast to so small a span that it is scarcely worth considering, and it is remarkable how the constant tendency is to contract this to still smaller dimensions, and how a close examination develops unexpected facilities, diminishing the resources required in applying a method which is as flexible as it is exact.

The magnetic telegraph has given new precision to this kind of survey just in the point in which it was least strong, and has rendered the measurement of an arc of the parallel an operation of the same kind with the measurement of an arc of the meridian.

The triangulation extends unbroken from Maine to Virginia; has been commenced in North and South Carolina, and in Florida; is completed in Alabama and Mississippi, and commenced in Louisiana and Texas.

The plan of commencing the survey in different sections, resting it in each one upon a carefully measured base, and extending the triangles from

these bases until they meet, has been dwelt upon in my former reports, and appears to be generally approved by those who have examined it. The steady execution of such a plan to its conclusion, and a clear idea of the directions in which the work should advance to completion, are required, to realize the advantages of the system. It appears fragmentary while in progress, but the fragments fit—the parts are made by rule, and are uniform in character, and will form, when united, a complete and perfect whole. The loss which may be sustained by arresting any portion of the work cannot fairly be charged against the system.

The operations themselves are so essentially connected that confusion and loss would be consequent upon any separation of them. The advantage of uniform scientific methods cannot be overrated. Every part of the work has relation to that which is to follow. The reconnaissance is not made for itself, but for the triangulation. The triangles are not laid out for the sake of triangulation, but in reference to the plane-table work and hydrography which are to follow, and the topography in turn adapts itself to the wants of the hydrography. Thus, from first to last there is unison, and without that the result would be disastrous. The astronomical and magnetic observations have the same practical reference. This is by no means the natural course of things, but results from the union of the different parties in one work. It is easily seen that the same facilities do not occur for each kind of operation in the same place, and that if the operations were dissevered the preceding one might have little value for that which followed. If the land work is not precisely suited in time and in kind to the hydrographic determinations, it is a serious drawback to the latter, and if made without close and entire connexion with it, the result would be waste and inaccuracy.

The several operations of the parties have been carried on according to directions approved by the Treasury Department on the 23d of March, 1849. More or less detailed instructions have been given by me to each of the chiefs of parties on commencing the work of the season, and have been followed up from time to time by others, as the monthly reports or correspondence showed their necessity in executing the plan for the section, in which the operations of several persons and parties employed are combined. Each party keeps a daily journal, an abstract of which is transmitted to the superintendent at the close of the month, with the reports of work done in the different branches of the office. At least once during the quarter the proof-sheets of the engravings in progress are also sent for inspection. The work in the office, the drawing, engraving, and printing, and, as far as practicable, the instrument making and publishing, proceed according to a programme previously arranged. On closing his season's work, about the first of October, the chief of each party makes a report which contains a summary of his year's work. Personal examinations of the operations of the parties have been made by me where it was practicable, and such verifications by me personally, or by one of the assistants, as time and opportunity have permitted. The amount and character of the work executed appear to me highly creditable to the officers of the survey, and in general there has been great economy in the expenditures. High testimony has been borne both at home and abroad to the character and progress of the work, and the comparisons made by your predecessor

of the relative expenditures and results of the survey and of similar ones in other countries, (Ex. Doc. No. 26, 30th Congress, 2d session,) showed a very decided difference in favor of our economy. A comparison which I had occasion to institute in my report of last year with the land surveys, showed that in the matter of actual cost per linear mile surveyed, converting our topographical areas into equivalent linear surveys in order to produce similarity of operation, our topographical surveys had the advantage.

In pursuance of the direction of the law to employ as many officers of the army and navy in the work as practicable, applications have been made from time to time for officers in both branches of the service. The hydrography being exclusively executed by officers of the navy, I have added new parties or vessels whenever the progress of the work in the different sections, and the appropriation from which the surveying expenses are derived, would permit. The Navy Department has with great liberality answered these calls, gradually increasing thus the number of its officers upon the work, which now amounts to fifty-four—namely, twenty lieutenants and thirty-four passed midshipmen.*

Within the past year the changes in the officers of the hydrographic parties, from various circumstances, have been so rapid that more than half of those now attached to the survey have been ordered to it since my last report. We have lost three chiefs of hydrographic parties who were most valuable to the work, and whose experience we shall miss, even though their other qualities may be supplied by their successors. One of these officers, Lieutenant Charles H. Davis, has been selected for the important scientific duty of preparing an American Nautical Almanac; and two others, Lieutenants David D. Porter and Richard Bache, have taken steamers to the Pacific.

While the object of Congress to render the survey a school of application is answered by these rapid changes, the work itself suffers in its progress, from the loss of the experience which it imparts. The knowledge of the steam engine acquired in our surveying steamers is of itself of great value to the service, and through it to the country; it is, however, necessarily paid for by the survey. The familiarity with the coast and its harbors which the officers of the navy acquire by this service is also of the highest importance to the country; and the nature of the service and its connexion with the science of the country, are favorable to the development of those qualities in the younger officers which make them ornaments to their profession.

The general progress of the coast survey may be thus summed up. In the first section, sketch A, (Maine, New Hampshire, Massachusetts, and Rhode Island,) the primary triangulation and astronomical and other observations connected with it have reached Portland, Maine, the minute reconnaissance extending to the Kennebeck, and the general reconnaissance to the Penobscot. One party, uninterruptedly engaged in this work, could finish it to the boundary in two to two and a half seasons. A base of verification has been measured on the Boston and Providence Railroad. The secondary triangulation has reached New Hampshire, and the preparation of putting up signals has been carried to Kennebunk, in Maine. The to-

* Since this date, the number has been reduced to eighteen lieutenants and twenty-seven passed midshipmen.

pography has reached Cape Ann, with an interval to be filled on the eastern side of Massachusetts Bay, from Harwich to Scituate. The hydrography of the south shore of Massachusetts is complete to Nantucket Sound, embraces nearly the whole of Nantucket Shoals, and has been completed in Hyannis, Bass River, and Wellfleet harbors of refuge, and in Boston harbor and its approaches. The rest of the work in this section, except the topography and hydrography of part of Narragansett Bay, is complete. Observations for difference of longitude, by chronometer, between Cambridge and Europe, are in progress. The charts of New Bedford, Holmes' Hole, Tarpaulin Cove, Edgartown, and Nantucket harbors have been published. That of Hyannis is engraved. The "general coast chart" from Narragansett bay to Cuttyhunk is engraving. So also the chart of Boston harbor, Muskeget channel, and the second sheet of the coast chart, are in the hands of the draughtsmen. Two manuscript charts, on a large scale, of Boston harbor and its approaches, have been prepared for the commonwealth of Massachusetts and the city of Boston. Preliminary sketches and notices of dangers, and facilities to navigation, developed by the survey, have been published.

The whole field work of the survey is in general complete in the next section, sketch B, (Connecticut, New York, New Jersey, Pennsylvania, and Delaware,) parts of which require an extension of the work, and others verification or re-survey. This is done as parties are disposable. The chief expenditure in this section is for drawing and engraving. Two charts of New York bay and harbor in six sheets, and one on a smaller scale in one sheet, have been published. The atlas of harbors of Long Island sound is nearly completed. Charts of the harbors of New London, New Haven, Black Rock, and Bridgeport, Oyster bay, Huntington bay, Cawkin's and Sheffield islands, Captain's islands, east and west, and of Fisher's Island sound, have been published. The chart of Sachem's Head is engraved; leaving only the mouth of the Connecticut, the anchorage at Hart and City islands, and perhaps an additional chart to be engraved. The eastern sheet of the general chart of Long Island sound has been published, the middle sheet is engraved, and the western is in the course of engraving. The western sheet of the south side of Long Island is engraved, and the middle and eastern sheet drawn. The off-shore chart, comprising the coast of Connecticut, New York, and New Jersey, from Block island to the capes of the Delaware, is drawn and nearly engraved. A chart of the passage between East River and Long Island sound, (Hell Gate,) has been drawn. Buttermilk channel, in New York harbor, has been re-surveyed, and a chart published. The Delaware bay and river, in three sheets, including the approaches, has been published. A chart of Little Egg harbor (of refuge) on the coast of New Jersey, has been published. A part of these engraved plates are electrotyped, so as to use copies which are facsimilies of the original.

In the next section, sketch C, (Delaware, Maryland, and Virginia,) the primary triangulation, and secondary connected with it, will be completed in less than three years, having now reached the Rappahannock in their progress down the Chesapeake. The secondary triangulation on the outer shore is similarly advanced. The triangulation to connect the primary work and the capitol requires the occupation of but one station to complete it. A base of verification has been measured on Kent island. From

the Seaton station, at Washington, we expect to reach all the principal points on the coast through which the telegraph passes, determining the differences of longitude with a precision not heretofore attained. Washington, Philadelphia, New York, Cambridge, and Cincinnati, (one of the steps to New Orleans by the western telegraph routes,) have been thus connected, and the astronomical observations at Western Reserve College have been rendered available for our work by its telegraphic connexion with Philadelphia. The topography in this section, both of the shores of the Chesapeake and ocean shore, has kept pace with the triangulation as nearly as the convenience of the work permits. The hydrography of the Chesapeake has rather pressed upon the land work, and that outside follows it closely. An efficient *steam vessel* is much wanted for this part of the work; otherwise, as the Chesapeake widens, and the soundings come to embrace the mouth of the bay outside, the hydrography cannot keep up with the rest of the work. With a steamer which could keep the sea one hundred days during the working season, the main hydrography of this section would be completed in five years, and probably at no greater annual expense than now. Charts of Annapolis harbor and the entrance to Chester river have been published. A chart of the Patapsco and Baltimore harbor in two sheets is nearly engraved. The upper sheet of Chesapeake bay is drawn and engraving, and the drawing of a second sheet will soon be in progress. Materials for a third will at the close of the season be in the office, and will be at once reduced.

In the fourth section, sketch D, (Virginia and North Carolina,) the main and secondary triangulation of Albemarle sound, and the tertiary triangulation of the rivers emptying into it, except those at its head, and the topography of the shores, are completed. The triangulation of Croatan and Roanoke sounds, and the topography of the shores, are nearly completed. A base line has been measured on Bodie's island. The triangulation of Currituck sound is in progress, and that of Pamlico sound commenced. A small triangulation along the ocean shore is in progress to Cape Hatteras. The hydrography of Albemarle sound is two-thirds done. Hydrographic reconnaissances have been made of the inlets between Nag's Head and Hatteras inlet. The reductions are in progress for a map of Albemarle sound. The chart of Pasquotank river has been drawn, and is nearly engraved. This is the section having the smallest extent of shore line of the nine sections on the coast of the Atlantic and Gulf of Mexico, and the progress of the land work in it, in between three and four years, amounts probably to one-third of the whole. Had the steamer "Jefferson" answered our expectations, we should have been able to speak as positively in regard to the hydrography.

In section five, sketch E, (South Carolina and Georgia,) a general reconnaissance of the coast has been made, so as to decide upon the plan of the work, and to form an idea of the difficulties and facilities in different parts of the section. This is one of the newest sections, the work having been only commenced in it in the winter of 1847–48. The land work of Charleston harbor has been completed, including the triangulation and topography, and the astronomical observations required have been made. The approaches to the harbor from the ocean have been sounded out. A hydrographic reconnaissance has been made of Bull's bay, on the

coast of South Carolina, important as a harbor of refuge. The computations required for the chart of Charleston harbor have been made, and the drawing is in progress. A sketch of the harbor of Bull's bay has been published. The base line for the main work has been laid out on Edisto island, and the arrangements for its measurement are in progress. The sides of the main triangles have been traced from the base to the stations east of Charleston. The small secondary triangulation will be pushed both south into Georgia and north from the base, so as to serve as a minute reconnaissance for the primary.

The sixth section, sketch F, (part of Florida,) was commenced last winter by a reconnaissance of the Florida reefs and keys; and a special appropriation being made by Congress, the triangulation was at once commenced near Key West and Bahia Honda, and astronomical observations were made for fixing the geographical position of Key West. The rapid advance of summer, and other circumstances, necessarily prevented more than a beginning there, and the parties are now under instructions to resume work as early as the season will permit. Two land parties, (one a double one,) and a hydrographic party, have been organized for the purpose. The plan of operations proposed, and the reasons for it, will be described in a subsequent part of my report. More than two-thirds of the part of the coast of Florida which is comprised in section seventh, sketch G, has been reconnoitered, and work may be commenced there whenever the appropriation permits. A hydrographic reconnaissance of the entrance to the St. Mary's and St. John's rivers has been made.

The eighth section, sketch H, (Alabama, Mississippi, and Louisiana,) was commenced by a reconnaissance in 1845, and the work has made very good progress in it. The triangulation of the delta near the city of Mobile, and of Mobile bay and Mississippi sound, to Cat island and the shores of Lake Borgne, is nearly complete, and the topography more than half advanced to completion. The positions of two points have been determined by astronomical observations. A base line for the work has been measured on Dauphin island. The hydrography of nearly two-thirds of Mobile bay is done, including the entrance; part of Mississippi sound and Cat and Ship island harbors are complete. The charts of these harbors have been drawn, and the engraving is nearly completed. The chart of the entrance of Mobile bay is in the hands of the draughtsman. Sketches of hydrographic reconnaissances of Cat and Ship island harbors, and of Mobile entrance, have been engraved and distributed. The work in this section will be recommenced as soon as the season permits.

The ninth section, sketch I, (part of Louisiana and Texas,) was commenced but two years since. Galveston (upper and lower) bay has been triangulated on a base approximately measured. Astronomical and magnetic observations have been made at one station, and it has been connected by chronometer differences with a station in section eighth. It is proposed this season to carry the triangulation south from Galveston, and to commence the topography and hydrography of Galveston bay. The work will be thus in full activity.

Instructions for commencing section tenth (the coast of Oregon) were

given by the Treasury Department in July, 1848, and in the course of the autumn a land and hydrographic party were organized to proceed to Oregon. The land party is complete within itself for all the operations of the survey. The very unexpected change in the relations of the western coast has, of course, interfered materially with the usefulness, and added greatly to the expense of the parties. At the last advices, however, the schooner Ewing had arrived at San Francisco, having passed through the Straits of Magellan, under the command of Lieutenant Washington A. Bartlett. Lieut. Commanding McArthur, United States Navy, the chief of the hydrographic party, had also, after many delays and difficulties, not to say dangers, reached the same point, and thus Assistant James S. Williams and his party (Brevet Major Hammond, Sub-Assistant Joseph S. Ruth, and Wm. Humphreys, Esq.,) were furnished with the means of transportation, which had been entirely wanting before, to reach the coast of Oregon. I have no doubt, should our means prove adequate, I shall be able to give a good account of the labors of these parties.

This cursory glance at the work on our extended coast which has been done, will, I trust, serve to give confidence in the steady advance towards completion of all parts of the survey. In four of the sections data exist for a tolerable approximation towards the time of completion of the different parts of the work, with the means as they now exist; in four others they will be furnished in three years, making at that time eight of the sections in regard to which the estimates of time of completion may be presented with reasonable pretensions to accuracy. I have endeavored, in passing, to indicate some of the periods when, as now supposed, the operations will be completed.

As the sums directly appropriated for the coast survey, and those indirectly furnished by the War and Navy Departments in supplying officers, and the latter officers and men for the survey, have increased, the rate of progress of the work has been in a higher ratio; and I have endeavored, in forming reports, to show the economy which thus resulted from enlarging the scale of the work, while the period at which its benefits were felt was hastened, as well as that of the entire completion of the survey. Besides the general account just given, it is proper to state the progress during the past year separately from that of former ones. This notice I shall endeavor to render as brief as possible, as a full detail will be given in the subsequent parts of the report of all the operations derived from the reports of the officers engaged in them, and my own examinations. Each individual engaged in a work like this has a right to claim that he shall, as far as the case admits, receive full credit for work done, and the public statement by the head of the survey, of the amount of service rendered, is, at least in part, a fulfilment of his duty in the matter. With many, the opportunity of thus having their labors appreciated by the public, while it is a reward for exertion, also reacts as a stimulus. With all, the occasions of preparing annual reports serve as so many periods of reflection upon progress made, and of plans of operations and their relative degrees of success.

To be continued.

For the Journal of the Franklin Institute.

On the Construction of Permanent Road on Lines of Railway, and the Deterioration of the same. By JOHN HAMPSON, ESQ., *Engineer and Superintendent of the New Orleans and Carrollton Railroad.*

The construction of "Permanent Road" on lines of railway, and the deterioration of the same, have engaged the attention of many eminent engineers, as well as directors and others interested. An interesting report on this subject will be found in the proceedings of the Institution of Mechanical Engineers, recorded in the Civil Engineer's and Architect's Journal for June, 1849, which enumerates several different methods, and sets forth the conditions necessary to secure stability. The different modes of construction mentioned are stone blocks, various arrangements of cross sleepers, longitudinal bearers, with and without cross sleepers. The plan of sills under cross ties is not mentioned, which, for the combination of stability, facility of repairs, and surface drainage, (which it will be admitted are very desirable conditions,) is, in my opinion, far preferable to any of the plans specified. It is true the first cost of this method of construction is somewhat more than that of longitudinal bearers on cross ties, but the advantage of having the sill timber covered and excluded from the action of the air, (consequently increasing its durability,) and the diminished liability of the ballast being crushed out sideways, (on account of the weight of it, or earth above the sill,) with the other conditions it affords, will well repay the extra cost, whilst, with a good rail and the cross ties sufficiently close to bear the traffic, it will be as steady as the longitudinal bearer system, which requires the best kind of timber, and which is more exposed to the action of the weather; besides it involves the necessity of taking up at least two rails to replace a defective piece, while, in the sill arrangement, a defective cross tie can be replaced without removing any rail.

I have adopted the sill plan in relaying one of the tracks of the New Orleans and Carrollton Railroad, and it has been tested in an extraordinary manner, for *immediately* after its completion a portion of it was submerged by the water from a crevasse in the levee of the Mississippi, so that the top of the rails were two inches under water for over a month; and in consequence of the other track having given way, it had to be, and was, constantly used during that time for trains of from one to three hundred passengers. It is now in use, and has not required the least amount of repairs; nor has it settled or given way in any particular. It will, perhaps, be difficult to credit this statement,—it is, nevertheless, true, and can be substantiated by numbers of thinking men. The alluvial nature of the soil, and the absence of anything like ballast, prompted the use of shells for a substratum. These shells are found in immense banks or piles on the shores of the lakes in the vicinity, in some cases elevated 20 feet above the surface of the water. They are a bivalve of about 1½ inches in diameter, in shape similar to the clam, and are of a species of which I have not seen a living specimen. The shells cost, delivered on the railroad, 25

cents per 4 cubic feet. This price, with any regard to economy, makes their application limited.

The plan I have adopted to secure stability and facilitate drainage with the least expenditure of shells, is to dig a cross trench every 20 feet of 20 inches wide, and sufficiently deep to allow six inches in thickness of shells, on which is laid a cross plank $2\frac{1}{2} \times 15$. This is well rammed down to the level required, (by two men, with a piece of solid timber about 5×8 inches, and 7 feet long, thinned in the middle for convenience of handling,) when it is secured from springing or rising up by a stout stake driven at each end, to which it is nailed. These cross trenches are dug out to the side ditches and filled with shells to form blind drains. Longitudinally under each rail a trench of 20 inches wide is dug, in which shells are put from 6 to 10 inches deep, according as the soil is more or less aluminous, on which are laid plank $2\frac{1}{2} \times 15$ inches, and 20 feet long, or such length as will reach from centre to centre of cross planks. These planks are well rammed down as before, till they rest on the cross plank, to which they are nailed; and to keep them down in the centre they are nailed to a stout stake driven on each side. On these planks others are laid, $2\frac{1}{2} \times 12$ inches, so as to break joints, and nailed on the edges, so as just to keep them from springing up; this constitutes the sill. On this I put cross ties 5×8 inches, so as to lie well, which are fastened down by $1\frac{1}{2}$-inch trenails, the holes for which are bored in each end of each cross piece, alternately slanting, completely through the sill plank, thus holding the two planks and cross piece firmly together, and, in fact, splicing the sills from end to end in a most efficient manner. The cross pieces, which are three feet from centre to centre, are then adzed down to the level, and the rails laid; the track is then filled up with earth and finished. This is the construction which was submerged, and which has stood the test so well.

It may be as well to mention the size and weight of rails, also the plan of chairs and joints. The rails are in 21 feet lengths, of the H or double T pattern,—are 3 inches high, $3\frac{1}{2}$ inches base, and weigh 54 lbs. to the yard; the ends are sawed off square, and a piece punched out of each corner of the base, so as that, when they are put together, a space will be left between them for a $\frac{1}{2}$-inch square T-head spike, which holds the rails down and prevents end movement. I applied India rubber under the joints in a single-lipped chair, a drawing and description of which is given by me in the Railroad Journal for May 26, 1849, appended to the advertisement of Mr. J. C. Smith, the patentee for the application of India rubber under the rails of railroads. The joint still remains as perfect as then stated, and I can now recommend it with still more confidence since the severe trial to which the road was subjected.

The stability of our road under such circumstances has prompted me to write this detailed description, to the end that others who may have to construct a railroad on so bad a soil, with a scarcity of ballast, may see what has been done, and perhaps to add something worthy of note to the general stock of knowledge on the subject of the construction of permanent way.

AMERICAN PATENTS.

List of American Patents which issued in May, 1850, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Printing Presses;* F. J. Austin, City of New York, May 7.

Claim.—"I claim the mode of governing the vertical motion of the type bed, by the conjoint application of the crank and two part pressing bar, made as a hollow cylinder and slide, with a stop shoulder to give the upward motion, and pressure, and arranged to lengthen by sliding out at the back motion of the crank, and the combination therewith of the grooved cam and backing bar to regulate the descending motion of the type bed as described.

"I claim the application of the rotating cams to act through the fork and connect or disconnect the clutches, to give the shaft *c* 6 a rotary motion during half the rotation of the shaft *b*, and suspend the motion of the shaft *c* 6 by the disk and pins on the fork during the other half of the rotation, so that the shaft *b* goes two continuous revolutions to one intermitted revolution of the shaft *c* 6, such intermitted revolution being applied to give an intermitted alternate motion to the double paper carriage in a printing press, or to give any similar intermitted alternate motion by any competent means substantially as described and shown.

"I claim the application of the crank, male wheel, fixed female wheel and connecting bar for the purpose of communicating the intermitted alternate motion to the double paper carriage, substantially as described."

2. For an *Improvement in Bran Dusters;* Ezra R. Benton, Milwaukie, Milwaukie county, Wisconsin, May 7.

The patentee says,—"The nature of my invention consists in the construction of a machine for separating the flour, shorts, and dustings from bran as it comes from the bolts, which machine or bran separator, as it is called, is composed of one exterior stationary and two interior revolving cylinders, so formed and arranged that the interior cylinders rotate in opposite directions and agitate the bran and other stuffs subject to their action, and separate the flour, shorts, and dustings from the bran, depositing each quality of stuff in different receptacles, and thereby saving a large per centage of flour, &c., which would otherwise be left in the bran, and greatly increasing the profits of milling."

Claim.—"What I claim as my invention, is the combination and arrangement of the exterior stationary shell or cylinder, the intermediate revolving cylinder covered in sections with wire cloth of different qualities, and the central revolving cylinder with the ventilator for the admission of air, and the openings between the staves in the cylinder for the emission of air to drive the flour and other stuff separated from the bran, through the wire cloth, the several parts with their driving gear and apparatus being constructed and arranged substantially as herein described and intended for the purposes set forth."

3. For *Improvements in the Construction of the Frame, Roof, and Floor of Iron Buildings;* James Bogardus, City of New York, May 7.

The patentee says,—"The first part of my invention consists in making the horizontal beams which form the horizontal parts of the frame work, in sections cast with flanches through which longitudinal bolts pass to secure and draw together the sections at their junctions, their upper and under surfaces being horizontal and parallel flanches when this is combined with vertical columns, pilasters, or posts, also cast with horizontal flanches at top and bottom, provided with bolt holes in the horizontal flanches of the beams, the top end of one column, pilaster, or post, and the bottom end of another being bolted to the lower and upper horizontal flanges of two beams, to bind together the same in addition to the bolts which draw together the beams.

"The second part of my invention which relates to the method of making the floors, consists in making such floors of narrow plates or sheets of metal with tongues and grooves made on the edges by rivetting to the under surface of the plates, or sheets, a strip of sheet iron to form the tongue, and one or two strips to form the groove, the said strips acting at the same time as ribs, to give stiffness to the plates or sheets which constitute the floor, all the said plates being arranged, when put together, to break joints, by which means I am enabled to make a floor which, for rooms of ordinary size, needs no intermediate supports.

"The third part of my invention which relates to the method of covering the roof by means of a series of plates, consists in making one edge of each plate with a groove in the same manner as in the door plates, to receive the opposite edge of the next plate, and thus make one plate lap over the other, and bind the two together that they may not be separated to permit the passage of water, these plates being also provided with cleats or small plates rivetted on one end of each plate, and made to overlap the end of the next, and projecting beyond the lower edge of the large plate to lap over a corresponding and like plate or cleat on the next plate, and thus lap all the joints of the roof."

Claim.—"What I claim as my invention, is the method substantially as herein described, of making the frame work of iron houses of more than one story, by means of beams cast in sections with end flanches, which receive bolts for uniting and drawing them together, and with top and bottom parallel flanches; when this is combined with columns, pilasters, or posts, cast with horizontal flanches at top and bottom, the top flanch of one column and the bottom flanch of another being secured by bolts to the horizontal flanches of two beams, one column above and the other below the point at which the beams are joined, for the purpose and in the manner substantially as described.

"I also claim the method substantially as herein described, of making the floors by means of thin plates of metal formed with a groove on one edge and tongue on the other, by riveting narrow strips of metal to their under surface and near the edges, the plates so formed being put together breaking joints substantially in the manner and for the purpose specified.

"I also claim the method substantially as described of covering the roofs of houses by means of series of thin metal plates or strips to the under surface thereof, that the edge of one plate may fit into the groove on the lower edge of the next above, and so on throughout the series substantially as described, when these plates are also provided with the lapping pieces or plates, riveted or otherwise secured to the upper surface of one end of each plate in each series to lap over the end of the contiguous plates of the next series, the said lapping pieces of each series being also made to lap one over the other substantially as and for the purpose specified."

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4. For an *Improvement in Air Heating Stoves;* James L. Cathcart, Washington, D. C. May 7.

Claim.—"What I claim as my invention, is, 1st, a grate combined with and around the hollow cylinder through which the air passes and becomes heated.

2d, A conical hood placed above the air cylinder and the grate, and connected with a smoke pipe for the purpose of creating a draft concentrating the heat and conducting off the smoke or gas from the burning wood or coal.

"3d, The placing the grate on friction rollers as described in connexion with the cylinder, for the purpose of clearing the grate of ashes or bringing any part of it under the operation of a stronger draft or current of air.

"4th, The combination of the air pipes or air passages with the hood as described, by which the air that has become heated in the cylinder is conveyed to the room or place to be warmed.

"5th, The circular fender which is also made to answer the purpose of a blower by being raised and connected with the hood as described.

"6th, The method of introducing air into a hollow cylinder or air chamber connected with and inside of the grate, and taking the air from beneath the hearth."

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5. For an *Improvement in Bedstead Fastenings;* Harrington & Coolidge, assignees of Chas. C. Coolidge, Boston, Massachusetts, May 7.

Claim.—"What I claim is the lip in combination with the pawl and ratchet arc substantially in the manner and for the purpose as described; and when the bedstead bottom is made of the said flexible strips having such a flexibility as to enable them to be readily wound upon the windlass, and unwound therefrom as stated.

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6. For an *Adjustable Mouth Piece to Road Scrapers;* Shadrach Davis, Dartmouth, Bristol county, Massachusetts, May 7.

Claim.—"What I claim as my invention, is combining with the body of a scraper a mouth piece, which can be adjusted to form various angles with the bottom of the scraper substantially in the manner and for the purposes described."

7. For an *Improvement in Mechanical Leeches;* Marcellin Delluc, City of New York, May 7.

The patentee says,—"The nature of my invention consists in the construction of two instruments, the first designed to create a vacuum upon the skin, and to pierce it with a lancet shaped like the letter V pressed smartly by a spring; the second, intended to be placed upon the puncture thus made, draws the blood by making a vacuum like a pump."

Claim.—"What I claim as my invention, is, 1st, the arrangement of the wire, of the button, and of the covering of the instrument connected with the piston rod by the India rubber tube, which allows the cylinder placed in the vacuum produced by the piston, to work without admitting the air.

"2d, The blades of the lancet shaped like a V."

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8. For an *Improvement in Defecating Sugar;* Robert de Massy, Paris, France, May 7.

Claim.—"I claim the process as described for the immediate separation of the sugar from all foreign matter, which injures the purification by the manner above set forth, by forming a solid saccharate of baryta, pressing, decomposing, and separating the solid cakes, and finishing the process as set forth to the almost total suppression of heat necessary to evaporation."

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9. For an *Improvement in Over Shoes;* Peter Dorn, Philadelphia, Pennsylvania, May 7.

The patentee says,—"My improvement consists in the manner of affixing an over shoe to a boot or shoe."

Claim.—"What I claim as new, is an over shoe covering the front of the boot at the sole, substantially in the manner and for the purpose set forth."

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10. For an *Improvement in Plough Cleaners;* Daniel D. Gitt, Butler Township, Adams county, Pennsylvania, May 7.

The patentee says,—"The nature of my invention consists in the combination of a vertical wheel, a rack, or notched arm, and a lever with a conical fluted roller placed under the beam and upon the cutter of a plough, for the purpose of working the said roller in the operation of ploughing and cleaning the plough; and also, the substituting for this arrangement (if desired) a self-acting combination, consisting of a self-adjusting wheel running in the furrow, having a crank connected with it, with a pitman working a lever attached to the rack or notched arm used in the first arrangement, and (the progress of the plough putting the wheel in the furrow in motion) by means of the crank, pitman, lever, rack and vertical wheel operating the conical roller, and thus cleaning the plough in the operation of ploughing."

Claim.—"What I claim as my invention, is the combination of the lever, notched arm and vertical wheel, with a conical roller placed under the beam and upon the cutter of the plough as above described, for the purpose of operating the conical roller and cleaning the plough in the operation of ploughing, as setforth."

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11. For an *Improvement in Cooking Stoves;* James R. Hyde, Troy, New York, May 7.

The patentee says,—"The nature of my invention consists, 1st, in the manner of constructing the fire box so that it shall not crack in the expansion and contraction to which it is subject from the great and unequal degree of heat to which it is exposed. 2dly, in the so-arranging of a flue in front of the stove as to admit the smoke and gases when the summer arrangement is used in boiling, &c., so that it has a free draught to enter the fire chamber above the fire; and 3dly, in dividing the sliding part of the hearth, so that either half shall slide under the stationary part or ends of the hearth in such a manner as that the sliding hearth is entirely out of the way, without the inconvenience resulting from having it project out beyond other parts of the stove as is usual."

Claim.—"What I claim as my invention, is, 1st, the mode herein described of constructing fire boxes for stoves, furnaces, &c., in two pieces, so that they are not confined as they are when made whole, or four pieces as described, but is free to move on its bed plate.

"2dly, I claim the manner herein described of dividing the sliding hearth of cook stoves in such a manner as to admit of its sliding under the stationary part, and be entirely out of the way: the whole being constructed in the manner and for the purpose, substantially as herein described."

12. For an *Improvement in the Screw Excavator;* Richard Montgomery, City of New York, May 7.

The patentee says,—"My invention is designed to effect the purposes of excavating either in or out of water, dredging mud, removing sand bars, deepening canals, elevating auriferous sands, loading coal, &c., on vessels or wagons, &c., &c."

Claim.—"What I claim as my invention, is, 1st, the employment of a screw excavator combined with an adjustable tube as above described, for the purpose of excavating and conveying off earth, said tube being placed at any angle, or vertically, or horizontally, as the case may require.

"I also claim the apparatus for sustaining, moving, and guiding the excavator as above described, by which it is combined with the prime mover so as to be readily pointed in any direction, said apparatus consisting of a ring with shifting bearings and a movable bearing for the shaft to rest in, which is connected with the prime mover by universal joints."

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13. For an *Improvement in Cooking Stoves;* Jordan L. Mott, City of New York, May 7.

The patentee says,—"The first part of my invention relates to the protecting of the boiler hole covers from the injurious action of intense heat, by lining such covers with a concavo-convex metal plate, which will bend to yield to the expansion and contraction due to the varying heat to which they are exposed and against which they protect the covers.

"And the second part of my invention relates to the supporting the oven and other doors when open, and consists of a lever or arm jointed or hinged to the body of the stove, and so connected with the door, that when the door is let down the said lever or arm is turned out to make a support on which the door rests."

Claim.—"What I claim as my invention, is the method of protecting boiler covers against the injurious action of varying temperatures, by combining therewith a lining made of metal so formed that in its cross section it shall present a curved line, that is, a line longer than a straight line as described.

"And I also claim the method of supporting the doors of stoves by means of a lever or levers, so connected with the doors, substantially as described, that the said lever shall be moved in and out by the closing and opening of the doors as described."

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14. For an *Improvement in Working a Rotary and Vertical Churn Dasher;* William R. Wash, Bridgeport, Fairfield county, Connecticut, May 7.

The patentee says,—"The nature of this invention consists principally in so arranging and combining in the same churn and upon one shaft, a horizontal rotary dasher, and a vertically vibrating dasher, that while the rotary dasher is operated for the purpose of agitating the cream, the vibrating dasher remains at rest; and that when the butter is produced the vibrating dasher may be operated for the purpose of gathering or consolidating the butter, and that without changing the connexion of the machinery while the rotary gear remains at rest."

Claim.—"The application of the shaft to communicate a vertical reciprocating movement to the dasher F, and a rotary one to the dashers M and G, so that either can be used as desired, as herein set forth."

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15. For an *Improvement in Straw Carriers;* William Pierpont, Salem, Salem county, New Jersey, May 7.

The patentee says,—"My invention consists in the peculiar construction of a seed separator and straw carrier, and its adaptation to a threshing machine, by which the straw is removed and the grain separated from it in a more effectual manner than by any other plan hitherto in use."

Claim.—"What I claim is an elongated apron or pierced platform, hung upon and worked by cranks connected with and forming a part of the threshing and separating machine, substantially in the manner and for the purposes herein described."

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16. For an *Arrangement of Several Slide Valves in the same Steam Chest;* Cyrus Richardson, Woburn, Middlesex county, Massachusetts, May 7.

The patentee says,—"My improved arrangement consists in making two or more valve seats in the same steam chest, with a valve cup to each seat—one of which is made in the usual form and is used when the engine has to draw its ordinary load, and the valve cups to the other seats are made of various lengths, longer than is usual, and are used when the

engine has less than its ordinary load, and graduates the quantity of steam used so as to apportion it in some measure according to the load, and thus enables the engineer to economize or reduce the quantity of fuel used to generate the steam.

"This is effected by stopping the ingress of the steam into the cylinder when the cylinder is one third, one half, or partially filled with steam, and by this means the expansive force of the steam is gained."

Claim.—"What I claim as my invention, is the arranging of two or more valves in the same steam chest, to open or close the several steam ports or passages leading to and from the cylinder of a steam engine, arranged and operated to graduate the admission of steam into the cylinders of steam engines in the manner and for the purpose substantially as above set forth."

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17. For an *Improvement in the Manufacture of the Oxide of Zinc;* Edme Jean Leclaire and Jean Joseph Ernest Barrnel, Paris, France, May 7; anté, dated Dec. 31, 1845.

The patentees say,—The object of the present invention is a complete reform in the art of painting, by substituting unalterable and harmless paints for those having lead and copper, which are poisonous substances, for a basis, and which are liable to speedy alteration, and never produce perfectly clear tints.

"This reform is effected by the discovery of methods of obtaining on a large scale the white and yellow of zinc and barytes, zinc green, and antimonial red, which products used as such, or combined with other harmless and unalterable colors employed in painting, form a complete scale of colors with all the intermediate grades."

Claim.—"What we claim as our invention, is, 1st, the use of a draft of air through the suction tubes described above, for oxidizing the metal and carrying forward the products, and the arrangement of tubs or basins for the reception of the heavier portion of the products as described.

"2d, The arrangement of the oxidizing chamber in combination with the receiving chambers, so as to allow the products which they contain to be gathered without entering the chambers."

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18. For an *Improvement in the Melodeon;* Amos L. Swan, Cherry Valley, Otsego county, New York, May 7.

Claim.—"What I claim as my invention, is, 1st, the employment of the arms in combination with the top of the bellows in the manner and for the purpose set forth."

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19. For *Improvements in Oscillating Valves of Steam Engines;* Thomas C. Theaker, Mansfield, Richland county, Ohio, May 7.

The patentee says,—"The nature of my invention consists in forming side passages or steam ways in the oscillating valves, and communicating with recesses formed in the valve chambers for the purpose of letting steam into said last named recesses, in order to produce a pressure of steam against the side of the valve opposite to that on which the steam is admitted, so as to produce a counter pressure on the oscillating valves for the purpose of reducing the friction on the same as described."

Claim.—"What I claim as new, is the recess sunk in the oscillating valve and communicating with the steam passage, in combination with the recess formed in the valve chamber, the same acting in the manner and for the purposes herein specified."

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20. For an *Improvement in Machines for Polishing Stone;* Amos Walter, Middletown, Shelby county, Indiana, May 7.

Claim.—"What I claim as my invention, is the manner or mode of giving a compound or double motion to the rubbers by means of two carriages, or a double carriage, each carriage moved by its respective cranks, substantially in the manner and for the purpose described, so that one motion of said rubbers will not interfere with the other motion; said machine can be propelled by any power now in use."

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21. For an *Improvement in Machines for Slitting Clothes Pins;* Oratia P. Allen, Rindge, Cheshire county, New Hampshire, May 14.

The patentee says,—"The object and purpose of my improvements, and the effect or result accomplished by them, is to cut the outer end of the elongated slot or fork of the pin in

a spreading form, (which is very desirable,) and to accomplish this by knives, formed on or attached to the same circular saw which forms the straight part of the slot, and this has never been successfully accomplished prior to the invention of my improvement."

Claim.—"What I claim as my invention, is cutting the two sides of the outer end of the slot or fork of a clothes pin on a regular sweep, by means of knives formed alternately on each side of the circular saw which cuts the straight part of said slot; and in the direction above explained, whether said knives be made of portions of the plate of said saw, and bent outwards as described, or in separate pieces, and attached to said sides of said saw."

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22. For an *Improvement in Stoves;* Anson Atwood, Troy, New York, May 14.

Claim.—"What I claim as new, is, 1st, the air chamber in which the air is heated previously to its admission to the fuel, in combination with the spiral apertures by which the heated air is caused to impinge on the upper surface of the fuel, substantially in the manner and for the purposes as described."

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23. For an *Improvement in Connecting Rods of Steam Engines and other Machinery;* Levi Bissell, City of New York, May 14.

Claim.—"What I claim as new, is the application of prepared India rubber, or of any similarly effective elastic substance in the parts forming the joints of connecting rods of steam engines and other machinery, for the purpose of preventing jars and breakage of the parts when a reciprocating motion is changed to a rotary, substantially in the manner described and shown."

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24. For an *Improvement in Steaming Grain Preparatory to Grinding;* Israel Jackson, assignee of Benjamin S. Broomell, London Grove, Chester county, Pennsylvania, May 14.

The patentee says,—"The nature of my improvement consists in causing the grain as it passes from the shoe of the hopper to the eye of the millstone, to traverse for a short space a highly heated current of steam, whereby the skin of the grain is at once softened and toughened without disturbing the texture of the body of the kernel. The consequence of this sudden superficial scalding is, that as the grain passes immediately between the millstones, the hull is at once rubbed by the stones clear from the body of the kernel; the bran remains in large flakes and is easily sifted out, the flour is completely detached from the bran and the yield in true flour is materially increased."

Claim.—"I claim in combination with a steam pipe and grain passage the deflecting partition for directing the steam upward and the grain downward, whereby the current of grain is steamed by direct contact with the current of steam at the moment before entering the mill, substantially as herein set forth."

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25. For an *Improvement in Balancing Sash;* Hiram C. Brown, Xenia, Greene county, Ohio, May 14.

The patentee says,—"The nature of my invention consists in so counter balancing window sash, that either may be raised or lowered by the same cord without running the other sash."

Claim.—"What I claim as my invention, is, 1st, in connexion, the grooves in the sash, the distribution in the several pulleys and friction wheels, and the cord attached to the bottoms of the sashes instead of their tops, whereby the cord and pulleys are kept entirely out of view; 2d, The combination of the barrel axle, ratchet wheel and pin, with its case or bearings, or their equivalents, with the cord and pulleys; the whole arranged and operating substantially as herein set forth."

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26. For a *Toothed Segment Lock for Fire Arms;* Dexter H. Chamberlain, Boston, Massachusetts, May 14.

Claim.—"What I claim as my invention, is the movable toothed segment and escapement or spring pawl, or any mechanical equivalent therefor, (the said segment and escapement being arranged within the trigger,) and the toothed segment or arc (of the hammer) in combination together, and with the trigger, hammer, and stock, and made to operate substantially in the manner as herein before specified."

27. For a *Cylinder and Trough Gold Washer*; Thomas M. Collins, Marion, Crittenden county, Arkansas, May 14.

The patentee says,—"My improved gold washer is composed of a trough having a bottom made of raw hide, leather, or some fibrous manufacture, and a wheel placed within the said trough, having its periphery wound with rope or covered with some other fibrous material."

Claim.—"What I claim as my invention, is the separating gold or other heavy substances from others of less specific gravity and water with which it may be mingled, by the use of a wheel or cylinder and trough—the periphery of the former and the bottom of the latter being covered and constructed substantially in the manner set forth."

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28. For a *Revolving Jaw Wrench*; Colver & Damrell, assignees of Nathaniel Colver, Boston, Massachusetts, May 14.

Claim.—"I claim the revolving jaw block, and feather, as combined together and with the screw shank, and made to operate substantially as specified."

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29. For an *Improvement in Connecting Skeins with Axles*; Abel Combs, Farmington, Trumbull county, Ohio, May 14.

Claim.—"What I claim as my invention, is the combination of the skein with the screws for the purpose of tightening the skein on the axletree as set forth."

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30. For an *Improvement in Preventing Fibres from Winding on Drawing Rollers in Spinning Machines*; John C. Dodge; Dodgeville, Bristol county, Massachusetts, May 14.

Claim.—"I do not claim as my invention the mere use of a roller under the front drawing, and turned by it in an opposite direction as the same has heretofore been applied and operated; but what I do claim, is the improved manner of applying and using the roller, the same consisting in placing it not exactly in contact with the lower front drawing roller, but at a distance therefrom, and by means of a separate or additional machinery, giving to it a rotary motion at the same velocity and in the same direction with those of the said lower front drawing roller; the whole being substantially in the manner and for the purpose as specified."

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31. For an *Improvement in Machines for Washing Table Furniture*; Joel Houghton, Ogden, Monroe county, New York, May 14.

The patentee says,—"The nature of my invention consists in placing the crockery or other articles of table furniture in a machine fitted to receive them, and then to wash them by turning a shaft, with arms and buckets so arranged as to throw the water upon the crockery with force, and thus acting upon and cleaning each and every article."

Claim.—"What I claim as my invention, is the construction of a cylinder with a cylindrical rack supported by an upright shaft resting upon and being within and supported by the cylinder, the rack having within it a conical rack and hoop to receive and hold table furniture; in combination with a curb containing a horizontal wheel with buckets to throw water upon the cylindrical rack; the whole supported by a frame, and by these mechanical means cleansing the surface of table furniture without the use of hands—the entire machine being arranged, combined and operated, substantially as is herein fully set forth."

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32. For an *Improvement in Cooking Stoves*; Jordan L. Mott, City of New York, May 14.

The patentee says,—"The first part of my invention relates to the mode of making the cover of the feeder which supplies the coal to the fire chamber, and which projects forward of the front plate, that it may answer the two fold purpose of supply door and damper, and when applied to parlor stoves admit of opening the front, as it is frequently necessary to admit a draught to the upper part of the feeder; and this part of my invention consists in making this door in two parts adapted to slide to and from each other in grooves made in or near the upper edge of the extended front constituting the feeder.

"The second part of my invention relates to a method of forming the bottom grate or a part thereof, by casting on to either the fire plate, front oven plate, or ash plate, projecting bars of the requisite size and at the proper distances apart to constitute a grate, whereby

these not only become better conductors of heat, but also much expense is saved in the casting of the bottom grate.

"The third part of my invention relates to the making of fire brick for the lining of stoves by giving them more strength to resist breaking, and when cracked or split, to prevent them from separating; and this consists in combining them with iron rods or wires, by either moulding or baking them on metal rods or wires, or wire cloth, or moulding them with holes for the insertion of metal rods or wires.

"The fourth part of my invention relates to the increasing of the heat at the bottom of the oven, and consists in effecting this by means of two series of flue tubes at the bottom of the oven, one series above the other, and with sufficient space between the several tubes for the circulation and passage of the heat into the oven, the said series of tubes being so connected with each other and with the flues, that the gaseous products of the combustion shall pass either through both at the same time, or first through one series and return through the other.

"And the last part of my invention relates to the support of the oven or other doors of the stoves, and consists in combining with the door to be supported a brace rod jointed to the outside of the door, and passing through a hole or loop in some part of the stove below, so that when the door is let down the said rod shall act as a brace and support, and when the door is closed the said rod shall be close thereto."

Claim.—"What I claim as my invention, is, 1st, I claim making the cover of the feeder projecting in front with curved sliding doors, substantially as described.

"2d, I claim forming the bottom grate by casting projections from the edge of the fire back, or the equivalent thereof, substantially as described.

"3d, I claim giving the required strength to the fire brick lining of the stoves to prevent them from breaking or separating when cracked by the heat, by the insertion into them of metal rods, or wires, or wire cloth, substantially as described.

"4th, I claim the combination of the two series of flue tubes arranged one above the other, and with a space between them all for the circulation and radiation of heat, for the purpose of giving a greater heat at the bottom of the oven substantially as described; and this I also claim in combination with the above arrangement of flues as described.

"And lastly, I claim the method of supporting and bracing the door or doors by means of the bracing rod hinged to the door, and passing through a hole below (or the equivalent thereof) and bearing against the bottom of the stove, or a stop, or the equivalent thereof, substantially as described."

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33. For *Improvements in Splint Machines;* Horace Patterson, Templeton, Worcester county, Massachusetts, May 14.

Claim.—What I claim as my invention, is the combination of the circular or tube cutters, their lateral wing knives or cutters, their rib knives or cutters, and the waste escape passages for the waste strips, substantially in the manner and for the purpose as specified.

"I also claim the improvement by which I am enabled not only to make round or cylindrical splints, but to introduce them to the dipping frames; that is, I claim in combination with the cutters for forming the round splints and passages for receiving them and conducting them to the dipping frames, the passages for the escape of the waste wood or strips, the same being applied together and made to operate in connexion with the reducing plane iron and the plates, substantially as specified."

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34. For an *Improvement in Threshing Machines;* A. S. Pelton, Clinton, Middlesex county, Connecticut, May 14.

The patentee says,—"My improvements, although all of them have reference to one object, namely, the effective separation of the grain from the hull and straw, are of a two fold character, and consist, 1st, in such a form and arrangement of beaters as shall effectually expel the grain from the heads without dissevering the latter from their stalks, or allowing the latter to clog and thereby retard the action of the beaters; and 2dly, in the adaptability of the machine to different and varying actions on the grain, partly by the adjustability of the beaters and partly the mobility of the feeding apparatus."

Claim.—"What I claim as my invention, is, 1st, the peculiar serrated and duplex conformation of the beaters, substantially after the manner and for the objects herein described; that is to say, consisting of a pair of plates diverging rectangularly from each other, and the latter consisting of teeth chamferred off from the inner side at their points as represented."

35. For an *Improvement in Sewing Machines;* O. L. Reynolds, Dover, Strafford county, New Hampshire, May 14.

The patentee says,—"The nature of my invention consists in a new construction, combination and arrangement of the parts of a sewing machine, whereby the working parts are caused to perform their duties twice during each revolution of the main shaft, or first mover, and thereby form two stitches.

"Also in the use of a piercer worked by the same motion as the needle, for the purpose of perforating the cloth previous to making the stitch; also in the use of a guide or leader through which the thread is passed as it comes from the spool by which it is supplied; this guide has such a motion that each time the needle (which is of the form of the bearded stocking or knitting frame needle) is passed through the cloth, the thread is led over its point, so as to be caught and drawn back through the cloth at the backward motion of the needle; also in the manner of holding the cloth to be operated upon."

Claim.—"What I claim as new, is, 1st, the adaptation of the bearded needle, such as is used in knitting or stocking frames, in combination with the manner of closing the beard or hook thereof, previous to drawing it back with the thread to prevent the point tearing the cloth, by passing it through the hole in the plate in the manner substantially as described.

"2d, The combination of the spring thread leader or guide, the arched spring, and the friction roller, for the purpose of leading the thread under the point of the beard of the needle."

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36. For an *Improvement in Suspender Buckles;* William Scarlett, Newark, New Jersey, May 14.

Claim.—"What I claim as my invention, is the constructing a buckle by combining a curved plate with an angular lever, substantially in the manner set forth."

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37. For a *Shell Propeller;* James Trees, Salem, Westmoreland county, Pennsylvania May 14.

The patentee says,—"My invention is based on the voluted form of certain sea shells, which have a single cell twisted helically around a central axis of which class of shells that represented in the drawing is a type."

Claim.—"What I claim as new, is giving the shell of a submerged propeller the form of a section cut from the open extremity of sea shells, of the class of which that represented in the drawing may be considered a type, the mouth of the helical tube at which the water enters being of greater area than its hinder extremity at which the water is discharged."

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38. For an *Improvement in the Joints of Stove Pipes;* James N. Warner, Buffalo, New York, May 14.

The patentee says,—"My invention consists of a pipe composed of lengths, upon each extremity of which a worm is swaged; when the pipe is to be put up, the worms of one length are entered by turning into those of the next ones, thus securing the whole together and forming a continuous pipe which cannot be accidentally disconnected."

Claim.—"What I claim as my invention, is the stove pipe herein described as a new article of manufacture."

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39. For an *Improvement in Machine for Polishing Raw Hide Whips;* Charles Baeder, City of New York, May 21.

Claim.—"What I claim as my invention, is the before described method of grinding, smoothing, and polishing raw hide whips, in the manner and for the purpose herein fully set forth: that is to say, by the combination of the endless revolving belts, between which the rough raw hide whip is placed, the suspended frame containing the upper endless belt being arranged and operated in the manner and for the purpose set forth."

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40. For an *Improved Arch Girder;* John Bevan, City of New York, May 21.

The patentee says,—"The first part of my invention consists in strengthening an arched girder or beam, and distributing the weight applied to or passing over it, by means of a metal strap, chain, or wire rope, which constitutes the chord, and which passes around the ends and over the entire length of the upper surface of the arch, whereby the arch is bound from end to end by the said metal strap, chain, or wire rope, to prevent it from spreading lengthwise; any tendency to elongate the chord having the effect to draw the said metal strap, chain,

or wire rope down on to the upper surface of the arch, and thus to distribute any weight or pressure applied at any one point over the entire line of the arch.

"The second part of my invention consists in providing the arched beam or girder with rollers at the ends, when this is combined with the metal strap, chain, or rope, provided with a tightening screw or coupling for the purpose of regulating the length thereof, to adapt it to the changes of temperature, and to camber the beam or girder."

Claim.—"What I claim as my invention, is the method substantially as above described, of strengthening arches by means of metal straps, chains, or ropes, which constitute the chords, and pass around the ends and over the arched surfaces thereof, without being attached thereto, substantially in the manner and for the purpose specified.

"And I also claim providing the arch or beam with rollers at the ends, around which the strap, chain, or rope passes, substantially as described, when this is combined with a coupling or tightening screw for varying the length of the said strap, chain, or rope, substantially in the manner and for the purpose specified."

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41. For an *Improvement in Machines for Drying Bagasse;* James H. Dakin, Baton Rouge, Louisiana, May 21.

Claim.—"What I claim as my invention, is the employment of a revolving or rotary inclined flue, as applied and used for drying the bagasse or compressed sugar cane, or any other green or wet substance intended for fuel, with the heat and flame coming from the furnace under the sugar kettles, or from any furnace whatever, all passing into or through this said inclined or rotary flue at one and the same time, causing thereby the said bagasse or compressed sugar cane, or other said substance intended for fuel, to become dry and combustible, and prepared for fuel, the moment that it has passed through said flue, using such machinery or mechanical means as I have herein described, or any other suitable mechanical agency or means that will enable me to carry out and put into practical execution or use the principle or principles herein set forth, described, and claimed, and to obtain the intended objects and results in combination as a whole."

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42. For an *Arrangement and Connexion of Screw Propellers;* Patrick S. Devlan, Reading, Berks county, Pennsylvania, May 21.

The patentee says,—"My propelling apparatus is composed of a principal and one or more supplementary propellers, suitably secured at the stern of the vessel, connected together by cog wheels, and enclosed in a chamber, the hinder side of which is open to the water. Water is supplied to the front side of the propeller chamber by pipes which pass through the vessel and deliver it to a water chamber immediately in front of the propeller chamber, and communicating with it by circular apertures in which the smaller propellers are placed."

Claim.—"What I claim as my invention, is the arrangement of the principal and auxiliary propellers connected by cog gearing or its equivalent with that of the water pipes, in the manner and for the purposes substantially as herein set forth."

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43. For an *Improvement in Harness Buckles;* Jacob S. Embich, Green Village, Franklin county, Pennsylvania, May 21.

The patentee says,—"My buckle consists of a plate of metal which is secured at one extremity to one strap, and is furnished at its opposite extremitiy with a bridge or staple beneath which the other strap is passed; a second plate is hinged fast to this bridge, and is furnished with two pins for holding the strap, (in place of the tongue of the common buckle,) which, when the plate is brought down upon the leather strap laying against the fixed plate, pass through holes made in the strap, and enter holes made in the fixed plate, thus preventing the strap from being drawn from between the two plates; one of the pins is constructed with a hooked extremity, which, springing into a recess made for the purpose, prevents the plate to which the pins are secured from being accidently withdrawn from the fixed plate."

Claim.—"What I claim as my invention, is a buckle constructed substantially as herein set forth, of a fixed plate and of a movable plate, between which the strap is retained by pins secured to the one plate and engaging in the other."

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44. For *Improvements in Hand Looms;* John G. Garretson, Salem, Henry county, Indiana, May 21.

The patentee says,—"My improvements in looms chiefly consist in the novel method of shedding the web by the direct action of the lathes upon the treddle, by means of the finger, at each backward vibration of the lathe, coming in contact with a shoulder or jog on the

treddle provided for that purpose, together with machinery attached to, and in, the body of the lathe, suitable for moving the finger successively from treddle to treddle, such as the nature of the fabric may require; also machinery suitable for propelling the shuttle back and forth immediately after the shed is produced."

Claim.—"What I claim as my invention, is the shedding the web by the direct action of the lathe on the treddles, by means of the movable finger and the finger-staff, or any similar fixtures for the purpose, bearing down the treddle, and thereby producing a shed in the web at the backward vibration of the lathe.

"I also claim as my invention the combined action of the hand, cam wheel, finger-staff, and the finger, upon the treddles, as above described, for the purpose of shedding the web by the backward vibration of the lathe.

"I also claim the combined action of the hand, cam wheel by the zig-zag groove, lifting slide, and drivers upon the picker staff, as above described, for the purpose of throwing the shuttle back and forth alternately at each backwark vibration of the lathe, immediately after the shed is produced, the loom to be propelled by hand or other suitable power; all the above parts being substantially as herein described."

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45. For *Improved Wickets for Lock-Gates;* Alfred Bell, assignee of John Jack, Nunda, Livingston county, New York, May 21.

Claim.—"What I claim as my invention, is making and arranging a sliding wicket gate in such a manner that when shut it shall rest upon its seat and make a tight joint, but when moving to or from its closed position, shall be raised from its seat and supported on wheels to diminish the friction, and, consequently, the expenditure of power required to open or close it; the power for operating it being applied through a lever, or its equivalent, so as to move the gate very slowly, but with great force, until it is started from its seat, and the weight thrown upon the friction wheels, and then to act upon it with diminished force, but move it faster, until it is fully open; thus counterbalancing as near as may be the force and the resistance.

"I do not claim the mere counterbalancing of the weight of the gate and the pressure of the water on its upper edge, by means of the pressure of the water acting upon a flange at its lower edge; but what I do claim, is placing a flange for this purpose in an inclined position, substantially as described, so that the vena contracta shall not prevent the issuing water from pressing against it."

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46. For an *Improvement in Machinery for Sawing Staves;* Edwin Jenney, New Bedford, Bristol county, Massachusetts, May 21.

Claim.—"What I claim is the mode of steadying a long cylinder saw, viz., by means of a shaft and proper connexions at one end of the saw, in combination with a series of friction rollers and their supporting frame, applied outside of the saw and made to bear against the curved surface of the same, and at or near its other or serrated end, substantially as explained."

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47. For *Improvements in Machines for Sawing Wood;* Spencer Lewis, Tiffin, Seneca county, Ohio, May 21.

The patentee says,—"The distinguishing characteristic of my invention consists in reducing and alleviating the laborious business of sawing fuel wood into short cuts suitable for burning in stoves, &c., by the combination and arrangement of certain mechanical devices with a reciprocating saw, by which the wood to be cut is held firmly between self clamping hinged jaws—the descent of the swinging sash (after the wood has been cut) serving to advance a horizontal suspended lever in a position to be struck and lifted by a rotating lifting arm fixed to a horizontal transverse shaft, and elevate the swinging sash over a spring catch, and at the same time raise the feeding lever through the agency of a transverse bent lifting arm, to be actuated by a forked arm on the transverse shaft, to operate a jointed reaching arm, to move the slide bar and wood in a position for another cut, by simply continuing to turn the crank handle."

Claim.—"What I claim as my invention, is, 1st, the combination and arrangement of the suspended vibrating feeding lever, and rotating forked arm, jointed reaching arm, rack and slide bar, with the self clamping self adjustive hinged jaws for holding the wood firmly during the operation of sawing—the feeding of the log being effected by means of the forked arm actuating the feeding lever in the manner described and represented.

"2d, I also claim the combination and arrangement of the suspended lifting lever and the

rotating lifting arm on the shaft, with the swinging sash as described—by which the descent of the swinging sash will cause the lever to advance toward the rotating lifting arm when the wood is cut—and thus elevate the swinging sash in the manner and for the purpose herein set forth.

"3d, I likewise claim the combination of the transverse bent lifting arm, and suspended lifting lever, with the suspended feeding lever,—bent rod for unlocking the spring dog, and vertical spring catch, as described, by which the feeding lever is engaged with the jointed reaching arm, simultaneously with the ascent of the swinging sash in the manner and for the purpose set forth."

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48. For *Devices for Discharging Ashes from Tuyeres;* James A. Maynard, Boston, Massachusetts, May 21.

Claim.—"What I claim is combining with the valve on the end of the discharge pipe, a scraper, substantially as described, so that the opening of the valve by the stopping of the blast shall cause the scraper to act substantially in the manner and for the purpose specified."

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49. For a *Method of Giving Rotary Motion to Fluid Iron in Casting Rolls;* John C. Parry, Pittsburgh, Pennsylvania, May 21.

The patentee says,—"My invention consists in a new and useful mode of communicating the requisite rotary or swirling motion to the melted metal, which I effect by means of a paddle or fan which is fixed and attached to the rod in the mould as described. This paddle is caused to revolve by turning the crank, carrying the wheel which moves the rod to which the paddle is attached. The paddle turns round in the lower journal, and the melted metal entering the mould in the lower coupling, meets the paddle as it rises in the mould, and by the action of the vanes turning round in the rising metal, produces a complete swirl or rotary motion which continues until the roll is cast."

Claim.—"What I claim as my invention, is the combination of the paddle or fan with the rod *i* and rod *r*, and the frame work and gearing for giving motion to the fan, for the purpose of producing the rotary motion of the iron in casting chilled rolls and similar castings."

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50. For an *Improvement in Feed Regulator for Canals;* Charles Ross, West Buddick, Van Wart county, Ohio, May 21.

The patentee says,—"The use to which this invention is applicable, is to so regulate by a self adjusting principle, the supply of water to mills or canals, that they may not be subject to a dangerous or inconvenient redundance (except in times of freshets) nor a deficiency when a supply may be obtained."

Claim.—"What I claim as my invention, is the combination of the box, the float L, sliding valve, segment gate, and float Z, arranged and connected with the mechanism, whereby they have a united action in the manner and for the purpose herein described."

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51. For an *Improvement in the Form of Rubbing Surfaces for Regulating Abrasion;* Christian Schiele, Frankfort, Germany, May 21; anté, dated November 23, 1848.

The patentee says,—"The nature of my invention consists in the application of a certain curved form to the construction of cocks or valves, pivots, millstones, or similar parts of machinery in general, (where the rubbing surfaces have to bear a pressure in the direction of their axes,) in order to lessen the friction or to regulate the wear of their rubbing surfaces."

Claim.—"What I claim as my invention, is the application of the curved form above described to the rubbing surfaces of cocks or valves, pivots of upright shafts, millstones, or other parts of machinery in general where the rubbing surfaces have to bear a pressure in the direction of their axes."

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52. For *Improvements in Attachments to Mills for Preparing Corn in the Cob for Grinding;* John M. Seely and William E. Tomlinson, Lockport, Warren county, Ohio, May 21.

The patentees say,—"The nature of our invention consists in attaching a cylindrical block or bush, by a recess or other device, to the balance rine in the eye of the runner of a pair of

burr or other millstones, the said block having inclined faces leading to throats opening beneath knives adjusted thereto, and the said throats winding around the periphery of the block and delivering themselves into the eye of the runner, so that ears of corn thrust into tubes of a size suitable therefor, in the body of a feeder or cap, will come in contact with the rotated knives, and be minutely cut up and fed to the millstones; the said tubular feeder or cap being either appropriately held or made stationary for that purpose, and the tubes therein being at a distance apart equal to that of the diametric distance of the knives apart."

Claim.—"What we claim as new, is the block, with its arrangement of inclined planes, knives, throats, and other devices, which adapt it to operate on corn cobs or ears of corn received from a suitable feeder, and also to be inserted in the eye and be driven by the irons of the runner stone of grinding mills, substantially in the manner and for the purpose described.

"We also claim the block, arranged as described, in combination with the tubular feeder, arranged substantially in the manner represented, and for the purpose described."

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53. For *Improvements in Power Looms;* John Shuttleworth, Frankford, Philadelphia county, Pennsylvania, May 21.

The patentee says,—"One part of my invention consists in combining the advantages incident to rising and falling heddles with those peculiar to the 'cylindrical jacquard:' that is to say, the formation of the shed in the warp is effected by a descending as well as an ascending motion of the heddles, and thus is avoided the unequal tension, and consequent liability of the warp to stretch and snap, which takes place in all cylindrical jacquards known to me.

"Another part of my invention consists in arrangements of structure in the cylindrical jacquard, to facilitate adjustment to the pattern, so as to enable the weaver to accomplish in a few minutes what is usually the work of hours.

"Another part of my invention consists in the arrangement of mechanism by which is effected the intermittent and gradual rotation of the cylinder.

"Another part of my invention consists in improvements on the mechanism for operating the picker staffs."

Claim.—"What I claim as new, is, 1st, the imparting to the heddle bearer a motion simultaneous with, and in opposite direction to, the vertical one of the cylindrical jacquard, by an arrangement of supplementary levers and their appendages as herein described, or by mechanism substantially equivalent, the scroll cam or split pulley being so arranged as to act alternately as a lock and guide, and as a cam.

"2d, The arrangement and combination, substantially as described, of a segmental shell and stoppers for the ready adjustment of the jacquard to the pattern."

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54. For a *Machine for Grinding Spiral Knives;* George Forbes, assignee of Silas Stevens, East Brookfield, Worcester county, Massachusetts, May 21.

Claim.—"What I claim as my invention, is the employment and use of the radial arm and its pivots or contrivances for supporting the knife, substantially in the manner, and connected with the other parts of the mechanism, as specified."

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55. For an *Improvement in Apparatus for Setting Logs in Saw Mills;* Thos. C. Theaker, Mansfield, Richland county, Ohio, May 21.

The patentee says,—"The nature of my invention and improvement consists in combining with the common hand-setting lever an alternate revolving cylinder, and sliding dog placed eccentrically to the centre of the cylinder, so that it can be changed to either of two circles of teeth on the face of the ratchet wheel, whose cogs incline in opposite directions, by which the motions of the ratchet wheel can be changed by the use of one dog only and one lever."

Claim.—"What I claim, is the combination of the alternating cylinder, eccentric sliding dog, cog, notch, and sliding spring, with the common vibrating hand lever, and concentric circles of teeth inclining in opposite directions, for turning the ratchet wheel, on the end of the pinion axle, to the right or to the left, for moving the log on the head or tail block, either to the right or left, toward or from the saw, as specified."

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56. For an *Improvement in Lathes for Turning;* J. D. White, Hartford, Connecticut, May 21.

The patentee says,—"The nature of my invention consists in providing what I call a 'movable way,' on which the tool stock slides, and by which it is guided, the said way being constructed with one end secured by a permanent pivot or vertical axis joint to the lathe

table, and the other end of the said way constructed with a slot in it, through which passes a set screw to hold that end of the way to the table, and also to allow that end of the way to be moved out and in, to and from the revolving axle on the lathe, so that when the tool stock is moving along on the slide with the tool in contact with the axle to be turned, the said movable way will so guide the cutting tool as to turn any axle or shaft of a tapering form; and also, by the said movable way being set parallel with the revolving axis to be turned, the cutting tool will be thereby enabled to turn journals or shafts of an equal diameter throughout.

"My invention further consists in providing two such movable ways to one lathe, and arranging the driving gearing at and on the middle of the lathe, having two head stocks and a chuck on the middle of the lathe, so that two cutters may be turning the different ends of a railroad car axle at one time, the one cutter turning the taper while the other is turning the journal of the axle at the other, which requires the operator's undivided attention.

"My invention further consists in providing an opening in the chuck, head stock, and chuck spur wheel, whereby the axle can be placed in and taken out of the chuck at the side instead of endways."

Claim.—"I claim the central stock heads, and the chuck, and the large spur wheel, with the slots in them, to allow the axle to be placed in and taken out of the chuck sideways; the large spur wheel being driven by spur wheels Q G S, and T T, the one T acting as a compensation gearing to the other, while the slot of the large spur wheel is passing the other spur wheel T, in the manner substantially as set forth."

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57. For an *Improvement in Quilting Frames;* William T. Barnes, Buffalo, New York, May 28.

The patentee says,—"The nature of my invention consists in a combination of standards, cross bars, or rollers, check rods or stays, screws and bands, so constructed that, by using them as described, fabrics can be quilted more beautifully and with greater facility than by the common mode."

Claim.—"I claim the folding and rolling the layers of any fabric (which it may be desirable to quilt) verily by the use of check rods attached to rollers as described; the rollers, when operating, made to revolve alternately till the fabrics are folded and strained to the desired tension and position."

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58. For *Improvements in Apparatus for Jointing Slats, Boards, &c.;* Alanson Blanchard, West Cambridge, Middlesex county, Massachusetts, May 28.

The patentee says,—"The object of this machine is to enable carpenters to reduce with great facility and little care, blind stuff, stair threads, or various other boards, to equal or unequal widths."

Claim.—"What I claim as my invention, is the combination of the frame with its supporting rails, the adjustable support or bed bar, its supporting and elevating screws and contrivances, and the movable clamping bars with their clamp screw mechanism; the whole being applied and made to operate together, and in connexion with the plane, substantially as specified."

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59. For an *Improvement in Making the Reservoirs of Metallic Lamps;* P. J. Clark, Meriden, New Haven county, Connecticut, May 28.

The patentee says,—"The nature of my improvement consists in forming the feeders of lamps, having their reservoirs made of tin or other sheet metal, of the same piece of metal which forms the sides of the reservoir, whereby I am enabled to construct the lamps cheaper and render them more durable, as only one solder joint is necessary: that is the joint or seam up the side of the reservoir."

Claim.—"What I claim as new in my invention, is making the shell of the lamp reservoir, with the feeder standing out from one side, of one single plate of metal, so as to require only one seam or solder joint, in the manner substantially as described."

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60. For an *Improvement in Galvanic Registers for Steam Boilers;* Arthur Dunn, Dalston, Middlesex county, England, May 28; anté dated October 12, 1848.

The patentee says,—"My invention consists in so combining and applying thermometric apparatus and electric currents as to ascertain the temperature and pressure of fluids in vessels, principally applicable to steam and other boilers.

"My invention also consists of combining electric apparatus with pressure gauges, in such manner as to ascertain and indicate when the pressure of a fluid arrives at a determined point."

Claim.—"What I claim is a galvanic battery or generator of electricity, and its current wires or conductors, an alarm or bell apparatus, and a mercurial column tube combined with a steam boiler, and made to operate substantially in the manner and for the purpose of indicating the temperature or pressure of steam in the boiler as specified."

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61. For an *Improvement in Apparatus for Jointing Boards;* David Foster, Whitestown, Oneida county, New York, May 28.

Claim.—"What I claim as my invention, is the combination of the grooved plane with the guides, the sliding posts and adjusting screws arranged in the manner and for the purpose described."

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62. For an *Improvement in Smut Machines;* Cyrus D. Gordon, West Martinsburg, and Samuel S. Gouldthrite, Lowville, Lewis county, New York, May 28.

The patentees say,—"The nature of our invention consists in scouring wheat or other grain between two plates having waved and fluted surfaces. One of these plates is stationary, and forms the upper plate of the outer casing of the machine, and the other plate forms the head of a revolving drum.

"The plates may be adjusted at any distance apart, according to the nature or size of the grain, so as to break the smut balls and separate the dirt from the grain without breaking or bruising the grain. The smut, dirt, &c., is carried off through apertures in the outer casing by a current of air, which is caused to circulate through the machine by means of the revolving drum. The vertical shaft on which the revolving drum is mounted, is provided with a cup into which the grain is fed, passing through apertures in its lower part on to the plate of the revolving cylinder; by feeding from the centre, we are enabled to use the entire working surface of the plates, and to take the grain from any direction in the room without moving the machine."

Claim.—"What we claim as new, is, 1st, the combination of the cup with the shaft, for the purpose of receiving the grain and conducting it all around between the plates, as described.

"2d, The adjustable bearing or guide for setting the shaft vertical, consisting of the box with the blocks and the screws, constructed and arranged as set forth.

"3d, The circular revolving winged and slotted drum in combination with the scouring plates, in the manner substantially as described, producing a current of air for carrying off the smut, dirt, and other foreign matter."

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63. For an *Improvement in Machinery for Making Copper Tubes;* Edward Hamilton, Bridgeport, Fairfield county, Connecticut, May 28.

Claim.—"What I claim as my invention, is the employment of the horizontal heat retaining conducting tubes, in combination with the grooved rollers, arranged and operating in the manner and for the purpose set forth."

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64. For an *Improvement in Machinery for Making Four Sided Buckles;* Alvin North, Oliver B. North and Stephen Frink, New Britain, Hartford county, Connecticut, May 28.

Claim.—"What we claim as our invention, is, 1st, the combination of the vibrating carriage, (in which is placed the die,) the toggle lever, or benders, the gauge bars, detacher, holders, and cutting lever; the whole constructed and operating substantially as described, and by means of which a four sided buckle is formed.

"2d, The combination of the sliding frame and the vibrating hook, with the grooved die and the fly punch, the whole constructed and arranged substantially as described.

"3d, The combination of the vibrating jaws, the cam and levers with the forming block and rod, and sliding bar, the whole constructed, arranged and acting substantially as described."

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65. For an *Improvement in Processes for Preserving Wood;* Charles Payne, South Lambeth, Surrey county, England, May 28; anté, dated January 9, 1842.

The patentee says,—"My invention relates to a mode of preserving vegetable matters by

causing them to be impregnated with solutions of metallic or earthy matters, and then by chemical decomposition to obtain the preserving matters employed in an insoluble state within the substance of the vegetable matter, treated when such effects are obtained by the combined processes of exhaustion, pressure, and chemical decomposition; my invention relating to a *mode* of *applying* such matters, and not to the use or application of such preservative matters generally."

Claim.—"What I claim as my invention, is the combination of the processes of immersion, absorption, exhaustion, pressure and decomposition, substantially in the manner and for the purposes as explained."

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66. For an *Improvement in Fanning Mills;* Jesse Roberts, Penn's Square Post Office, Montgomery county, Pennsylvania, May 28.

Claim.—"What I claim as my invention, is the employment of the racks, perforated gauge plates, hooks and confining rods, in combination with the shoe for confining and adjusting the riddles and screen in the shoe, in the manner described.

"I also claim the arrangement of the vibrating longitudinal inclined conducting trough, in combination with the transverse inclined conducting trough attached to the vibrating shoe for receiving the cleaned grain from the screen, and conducting it directly to the measure or bag, as described."

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67. For an *Improvement in Water Backs for Cooking Ranges;* Herbert H. and Frederick H. Stimpson, Boston, Massachusetts, May 28.

The patentees say,—"Our invention consists in providing a means of preventing the pipes and back from choking with sediment, and insuring a ready flow of the water throughout by casting the pipes on to the hollow back, each with a convergence towards the other, when the inside of the top and bottom of the hollow back converge with the same angle, and coincide respectively with the induction and eduction pipes, whereby air is prevented from collecting in the hollow back over the water and producing the snapping noise so often heard in such backs, and whereby, also, a ready flow of water is secured."

Claim.—"What we claim as our invention, is casting the induction and eduction pipes of the hollow back of cooking ranges, each with a convergence towards the other, when the lines of the inside of the top and bottom of the hollow back converge with the same angle, and coincide respectively with the lines of the induction and eduction pipes for the purpose and in the manner described.

"We also claim constructing the hollow back itself with the lines of the inside of the top and bottom, converging towards each other for the purpose of preventing the accumulation of air and securing a ready flow of water as described."

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68. For an *Improvement in Tailors' Measures;* Amos Stocker, Ogdensburgh, St. Lawrence county, New York, May 28.

The patentee says,—"The nature of my invention consists in providing a means for taking measures, which are used to form the fore part and backs of garments, to fit the forms of persons for whom they are intended."

Claim.—"What I claim as my invention, is the instrument as represented at Fig. 3, for ascertaining the slope of the shoulder, also the instrument represented at Fig. 2 for ascertaining the measure from the socket bone to a line perpendicular to the most prominent parts of the back, substantially as described, and for the purposes set forth in the specification."

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69. For *Improvements in the Preparation of Pile for Rugs, &c.;* John, Joseph and Francis Crossley, assignees of James Taylor, Loch Winnoch, Renfrew county, Scotland, May 28; anté, dated October 10, 1845.

The patentees say,—"Our improvements in the manufacture of carpet rugs and other piled fabrics, refer to that class of fabric which is produced by cementing the pile to strong cloth (which forms the back of such fabrics) by means of India rubber or other suitable adhesive substance: the difficulty experienced in arranging the lengths of wool or worsted yarn used in this manufacture to form the pile so that their ends shall form any desired pattern, has long prevented the successful working of this method of producing piled fabrics;

but by my improvement, I am enabled to lay down given lengths of differently colored yarn in such quantities as will admit of any required pattern being copied with precision and rapidity."

Claim.—"What I claim is the mode or process described of combining or arranging together, and in the pile, the threads or yarns composing the figure or figures, the same consisting in winding the said threads on a beam or roller by the aid of a collar, pattern, and index, and other contrivances essentially as specified, and cutting the said threads and transferring them on, and by means of the roller to the pile in the machine in which they are compressed, cemented and cut, all as explained."

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70. For an *Improvement in Sofa Bedsteads;* A. G. Warren, Norwich, New London county, Connecticut, May 28.

Claim.—"What I claim as new, is, 1st, the drawer with castors made so as to serve the double purpose of a receptacle for the bedclothes and a support for the back, as described."

"2d, I claim the sliding head and foot boards so connected with the back that they slide in or out, as the back is raised or lowered by the contrivances as above described, or other equivalent devices."

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71. For an *Improvement in Fanning Mills;* John Weidman, Littlestown, Adams county, Pennsylvania, May 28.

The patentee says,—"The nature of my invention consists of an improved construction and arrangement for operating the sieves in a winnowing mill, by which the shaking operation is more effectually accomplished, and thereby more grain is cleaned, and better cleaned, in the same time, than by any of the known modes,—and an improved adjustable tail board for separating the grain and chaff."

Claim.—"What I claim as my invention, is my improved construction and arrangement for shaking and operating the sieves in a winnowing mill, in the manner described."

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72. For an *Improvement in Electro-Chemical Telegraphs;* C. Westbrook, Washington, D. C., and Henry J. Rogers, Baltimore, Maryland, May 28.

The patentees say,—"The nature of our invention consists in recording telegraphic signs on a metallic surface, connected with the earth by a wire conductor at one end, and to a galvanic battery and the earth at the other end of the circuit, by the use of acidulated water, or other fluid, interposed between the point of the usual wire conductor leading from the operating apparatus, connected with a galvanic battery, of the ordinary construction, and the metallic surface, by which the use of paper is dispensed with; time also being saved in not having to moisten the chemically prepared paper when it becomes too dry for use, and in having the telegraphic signs more clear and distinct on the metallic surface than on the paper; and in avoiding the inconvenience arising from the fumes from the chemicals employed in preparing the paper, and evils arising from the corrosion of instruments—and annoyance to the operators in preparing and using chemical paper, and other inconveniences."

Claim.—"What we claim is recording telegraphic signs on the surface of a revolving metallic cylinder plate, or other equivalent surface, by means of an acidulated liquid or saline solution, or water, held between the point of the wire conductor and the metallic recording surface, by means of a non-conducting porous substance contained in a glass, or other non-conducting reservoir, in which the recording fluid is contained, to which the electric current from a battery is applied by means of any of the known forms of manipulators and anvils used for making and breaking the circuit—the recording fluid being applied to the metallic recording surface substantially in the manner herein fully set forth, by which the use of every description of paper is dispensed with, thereby saving great expense in telegraphing."

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73. For *Improvements in Machines for Shearing Cloth;* Amasa Woolson, Springfield, Windsor county, Vermont, May 28.

The patentee says,—"My improved machine belongs to that class or species of shearing machines which shears the cloth from end to end; and if the two ends be joined, it may be passed through the machine any desired number of times without stopping.

"Its peculiar characteristic is in the 'rest' against which the shearing knives cut. This 'rest' has heretofore been made in one piece, and so as to be moved laterally by the hand of

the operative who superintends the working of the machine, in order to provide for the swaying of the cloth from one to the other side of the machine. The object of my improvements is to provide a movable or changeable rest on each side of the stationary rest over against which the knives bear or draw, to remove or shear the nap; so that if the cloth in being fed along to the knives should be swayed to one side or the other of the machine, the rest will be extended or shortened accordingly, and the cloth will still be shorn close to the selvage and yet leave the requisite width of selvage on each side."

Claim.—"What I claim as my invention, is, 1st, a flexible rest, constructed substantially as described.

"2d, Making the rest susceptible of extension on each or either end by combining with the ordinary stationary rest, and on each side thereof a flexible and movable rest, as herein above specified.

"Lastly, I claim making an extension or flexible and movable rest, self-operating, or so as to be changed by the cloth itself in its passage through the machine; all as herein above set forth."

RE-ISSUE FOR MAY, 1850.

1. For an *Improvement in the Method of Rendering Lard;* Ebenezer Wilson, Cincinnati, Ohio, patented October 9, 1844; re-issued May 7, 1850.

The patentee says,—"The nature of my invention in the apparatus for extracting and rendering lard, &c., by the action of steam under high pressure, consists in combining with a steam tight tank provided with a perforated steam pipe for the admission of high pressure steam, and with a large discharge boiler and cover for the discharge of the residuum, a perforated false bottom above the perforated steam pipe, which perforated false bottom is to sustain the charge under the pressure and weight, and thus admit of the equal distribution and passage of the steam through the charge, and also to admit of the free and equal passage of the water of condensation.

"The nature of my invention also consists in combining with the said tank one or more try cocks near the top, and a regulating discharge cock at or near the bottom, for the purpose of discharging the water of condensation during the progress of the process, whenever, by the use of the try cock, the attendant ascertains that the tank is too full of water of condensation, and thus by these means insuring the free passage of steam through the charge.

"And the nature of my invention also consists in combining with the said tank a series of discharge cocks, arranged one above another for the purpose of drawing off the rendered lard, &c., as it floats on the water of condensation, and the foreign substances which by reason of their greater specific gravity will be found below."

Claim.—"What I claim as my invention in the above described apparatus for extracting or rendering lard, &c., by the action of high pressure steam, is combining with a steam tight tank, substantially such as herein described, and provided with one or more discharge holes for the discharge of the residuum, and with a perforated steam pipe at bottom for the introduction of high pressure steam, a perforated false bottom above the steam pipe to sustain the charge under the weight and pressure, substantially as described, to admit of and insure the free passage of the steam through the charge, and also the free descent of the water of condensation as described.

"I claim also, in combination with the tank substantially such as herein described, the employment of one or more try cocks near the top thereof, and a regulating discharge cock at or near the bottom, substantially as herein described, for the purpose of ascertaining when too much water of condensation has accumulated, and to discharge the same; to retain a sufficient space above for steam; to insure the passage of steam through the charge, as described.

"And finally, I claim, in combination with a tank substantially such as herein described, and for the purpose specified, the employment of a series of discharge cocks arranged at different levels, substantially as described, for the purpose of drawing off the rendered lard, &c., as it floats on the water of condensation, and thus insure the separation of the pure lard, &c., from all foreign substances, when this is combined with the relief or discharge cock, substantially as described."

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2. For an *Improvement in Pumps;* Birdsill Holly, Seneca Falls, Seneca county, New York; patented June 5, 1849, re-issued May 7, 1850.

Claim.—"What I claim as my invention, is the combination of the nozzle with the pump barrel in such a manner that the nozzle can be readily changed from side to side, and secured in any desired position, substantially as herein described.

"I also claim the manner of connecting the induction pipe, the valve and its seat, with the base of the pump, without the aid of rivets or solder, and in such a manner that, when the base of the pump has been securely fastened to a platform, the respective parts of the pump, as also the induction pipe, can be combined with the base, or detached therefrom without disturbing its fastenings;—to wit: by means of the cup rising from the centre of the base, which has a screw cut in its inner periphery and a hole in the centre of its bottom, through which hole the induction pipe is inserted and enlarged by a mandrel; the metallic disk placed within the said cup, with the tube descending therefrom, inserted into the upper end of the induction pipe, the leather disk from the centre of which the valve is cut, placed on the disk; and the whole securely combined with each other by inserting the screw formed in the outer periphery of the lower end of the pump barrel, within the screw thread formed in the inner periphery of the base cup, and turning the pump barrel until the lower end thereof forces the above enumerated parts into the position represented in Fig. 2."

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3. For an *Improvement in Feeders for Screw Machines;* Solyman Merrick, Springfield, Hampden county, Massachusetts; patented March 7, 1846, re-issued May 7, 1850.

The patentee says,—"The principle or character which distinguishes my invention from all other things before known consists, 1st, in arranging screw blanks, pins and other like or similarly headed articles, so as to present them with the points or heads all in the same direction by oppositely inclined beveled or curved surfaces, with sufficient space between them to receive freely the shanks of such articles, whilst they hang suspended by their heads, operated essentially in the manner hereinafter described.

"2d, In making one of the said inclined beveled or curved surfaces in two parts, one above the other, to aid in giving to the screw blanks or other articles the required tendency towards the space between the said surfaces.

"3d, In combining with the said oppositely inclined beveled or curved surfaces, a fence or guard plate placed across from one to the other, and over the space in which the screw blanks or other articles are suspended, to prevent the passage of any which may not be properly suspended.

"4th, In combining with the oppositely inclined beveled or curved surfaces revolving arms, wings or beaters, to knock or beat back the surplus screw blanks or other articles, and prevent any but such as are properly suspended from passing towards the point of delivery.

"And lastly, In combining with the said oppositely inclined and moving surfaces a checking and delivering apparatus, to deliver out in succession the screw blanks or other articles."

Claim.—"What I claim as my invention, is, 1st, the method substantially as described of arranging screw blanks, &c., by the motion of oppositely inclined beveled or curved surfaces, with sufficient space between them to receive freely the shanks of the blanks whilst they hang suspended by their heads, the said motion of such surfaces being in the direction of the space between them, substantially as described.

"2d, Making one of the said inclined beveled or curved surfaces in two parts, one above the other, substantially in the manner and for the pupose specified.

"3d, Combining with the said oppositely inclined beveled or curved surfaces, a fence or guard plate placed across from the one towards the other, and over the space in which the blanks are suspended, substantially in the manner and for the purpose specified.

"4th, In combining with oppositely inclined beveled or curved surfaces, revolving arms, wings or beaters, substantially in the manner and for the purpose specified.

"And lastly, In combining with the said oppositely inclined beveled or curved surfaces, a checking and delivering apparatus, substantially in the manner and for the purpose specified."

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4. For an *Improvement in Planing Machines;* William Emmons, administrator of Calvin Emmons, deceased, City of New York; patented June 27, 1848, re-issued May 21, 1850.

The patentee says,—"The nature of my invention consists in the construction and combinations of the several parts as hereinafter described."

Claim.—"What I claim as my invention, is, 1st, the combination of the lever frame, cam wheel, and plane stock, substantially in the manner described; by means of which combination and the configuration of the cam wheels substantially as specified, and the plane stock which is made to move in a different and lower line during its forward stroke, than during its backward stroke, in the manner and for the purposes described.

"2d, The combination and arrangement of the tonguing and grooving planes running with the slides, and the mode of adjusting the same in combination with the surface plane

the cam wheels and levers, substantially in the manner specified, for planing, tonguing and grooving boards and plank at one operation.

"And finally, the mode of contracting and expanding the grated bed in the manner specified, in combination with the tonguing and grooving planes."

Designs for May, 1850.

1. For a *Design for Painted Floor Cloth;* Deborah, Albert E., and Nathaniel B. Powers, Lansinburgh, Rensselaer county, New York, assignees of James Hutchison, Troy, New York, May 14.

Claim.—"What is claimed as my invention, is the arrangement of ornamental figures, forming a design for floor cloths as shown in the aforesaid drawing."

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2. For a *Design for Stoves;* Washburn Race, Seneca Falls, Seneca county, New York, May 14.

Claim.—"What I claim as my invention, is the ornamental shape and configuration of the respective pieces of casting for a stove, as represented in the accompanying drawings and herein specified."

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3. For a *Design for Stoves;* D. Root, Cincinnati, Ohio, May 21.

Claim.—"What I claim as new, is the particular form and design as described."

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4. For a *Design for Stoves;* Asa C. Brownell, Providence, Rhode Island, May 28.

Claim.—"What I claim as my invention, is the combination of the elongated horizontal panels, and vertical connecting panel, all having mouldings in alto relievo—with the several doors and panels having Gothic arches, with clustered raised ribs on their sides and mouldings, as specified and shown."

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5. For a *Design for Stoves;* Joel C. Bailey and Russel Wheeler, Utica, New York, May 28.

Claim.—"What we claim as our invention, is the design of the form of the plates, consisting of the peculiar manner the same are ornamented and constructed."

List of American Patents which issued in June, 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Suspending Venitian Blinds;* Joseph Bohrer, Philadelphia, Pennsylvania, June 4.

Claim.—"What I claim as my invention, is the combination of pulleys with cords for the independent movement of the supporting slat, in the manner and for the purpose described."

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2. For an *Improvement in Ventilating Railroad Cars;* Hezekiah Bradford and Ephraim Morris, City of New York, June 4.

The patentees say,—"The object of our invention is to introduce into the several cars of a railroad train, a current or currents of air taken from some point or points forward of the smoke pipe of the locomotive, and thereby not only to supply the cars with the required ventilation, but at the same time to produce in each car of the train an outward pressure of air, which will effectually prevent dust, smoke and sparks from entering the cars; and to this end the nature of our invention consists in combining with the railroad train a tube or tubes, united at the junction of each car in the train by a flexible or yielding joint, the said tube or tubes being carried forward of the chimney of the locomotive to receive the air in the front of the train, and the said tube or tubes being made to communicate with each car of the train, so that the current of air forced by the motion of the train into the forward end

of the tube or tubes where, from its location, the air cannot be charged with dust, smoke or sparks, may by the said motion be caused to pass the said tube or tubes into each car of the train."

Claim.—"What we claim as our invention, is the method of ventilating the cars of a railroad train, and keeping out dust, smoke and sparks, by combining therewith a tube made in sections and united by flexible joints at the junctions of the cars, which tube receives a current or currents of air forward of the chimney of the locomotive, and discharges it into the cars through apertures, all substantially as herein described."

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3. For an *Improved Gun Harpoon;* Robert Brown, New London, New London county, Connecticut, June 4.

Claim.—"What I claim as new, is attaching the line to both the shank and the head of the harpoon in such a manner that the extremity of the line is loaded with the harpoon into the gun, and lays in recesses made in the shank, and when the gun is fired the line will trail from the butt of the shank, and will not tend to depress the head during its flight."

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4. For an *Improvement in Fire Place Grates;* Gardner Chilson, Boston, Massachusetts, June 4.

Claim.—"What I claim as new, is, 1st, the combination with the open fire place or grate having the side draughts as described, of the air heating chambers, consisting of an air chamber surrounding the fire and a projecting chamber above surrounded by heat, substantially as set forth.

"2d, I claim dividing the draught of an open fire, and causing the products of combustion, to be drawn off at each end of the fire, as described.

"I also claim the sliding collar at the exit pipe in the manner and for the purposes specified."

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5. For an *Improved Method of Making Shafts, &c., of Sheet Iron;* Charles F. Fisher, New Orleans, Louisiana, June 4.

The patentee says,—"My invention consists in the construction of shafts for steam engines, water wheels, and other machinery, of the greatest possible lightness, compatible with strength and stiffness, and not expensive in construction."

Claim.—"What I claim as new, is the constructing of hollow plate iron shafts of short cylinders, combined and connected together in the manner and for the purposes above described."

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6. For an *Improvement in Printing Presses;* Charles W. Hawkes, Boston, Massachusetts, June 4.

Claim.—"What I claim as my invention, is, 1st, the application of the toggle lever working on the stationary cam, to raise the platen in the manner and for the purpose described.

"2d, I claim the combination of the toggle lever and toggles with the stationary cam, substantially in the manner and for the purposes set forth.

"3d, I claim the combination of the toggle lever and toggles, with the swing platen, as set forth.

"4th, I claim the combination of the spiral springs and the trip, when used in combination with the swing platen, substantially in the manner and for the purpose described."

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7. For an *Improvement in Brick Presses;* John W. Hope, City of New York, June 4.

The patentee says,—"My brick machine is constructed to grind the clay and to force it into the moulds; it also grasps the mould box firmly while the ground clay is being forced into it, and stops the discharge of clay from the machine when the filled moulds are withdrawn, to be replaced by empty ones."

Claim.—"What I claim as new, is operating the roll for holding the mould box, the gate for regulating the discharge of clay, and the piston for compressing the clay into the moulds by means of a wheel, furnished with series of teeth secured to it, and acting through trundles, shafts, cranks, and connecting rods, connected with the roll, the gate, and the piston respectively, substantially as herein set forth."

8. For an *Improvement in Gang Ploughs;* Joseph D. Hope, Philadelphia, Pennsylvania, June 4.

Claim.—"What I claim as new, is the spur wheel so constructed and arranged within the periphery of the driving wheel, that it may be made at pleasure to pass its rowels through the holes or notches in the tire into the surface of the ground when under compression, and thereby grapple and gain adhesion to the ground, substantially in the manner set forth.

"2d, I also claim the combination of parallel bars to regulate the breadth of each separate furrow, with the adjusting curve for determining the horizontal direction of the draught, so as to adapt the amount of work done by a single traverse of the engine, to the adhesive power of the wheels when applied to the particular kind of land under cultivation, substantially as set forth.

"3d, I also claim preventing the choking of the plough by means of the recurved point of the mould board, acting to turn aside and guide backwards the choking material, as set forth.

"4th, I also claim the manner of connecting the harrow to the locomotive, so that the conductor may at pleasure, by turning a crank, reverse its advancing side, for the purpose of freeing the harrow teeth from choking materials, in the manner substantially as set forth."

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9. For an *Improvement in Board and Log Rules;* Charles B. Hutchinson, Waterloo, Seneca county, New York, June 4.

Claim.—"What I claim as my invention, is the combination with the inner revolving plate of the rotary tape measure of the several tables thereon, substantially as described."

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10. For an *Improvement in Shuttle Motion of Looms;* Oliver A. Kelly, Woonsocket, Providence county, Rhode Island, June 4.

Claim.—"What I claim as my invention, is attaching the 'bat wing' by an adjustable connexion to one extremity of a lever, whose outer extremity is connected by a short strap, with the picker-stick, the lever turning on a single adjustable vertical pivot, and being interposed between the wiper operating as described, and the picker-stick, motion from the wiper being transmitted through this lever strap and picker-stick to the driver, so as to cause it to throw the shuttle with the proper degree of suddenness and velocity when the loom is working at a high speed; this arrangement admitting of the easy and quick graduation of the suddenness and velocity with which the shuttle is thrown, as set forth."

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11. For an *Improvement in Nursery Chairs;* Samuel S. May, Sterling, Worcester county, Massachusetts, June 4.

Claim.—"I claim the improvement of the movable back piece and its sustaining fixtures, in their application to the back and seat, substantially as specified, and for the purpose of using the chair either as a cradle or as a lolling chair, substantially as specified.

"I claim the above described improvement in the arm chair, the said improvement consisting in so combining one of the arms with the seat, by means of a slide adapted to such seat, that both the arm and slide may be moved in a direction away from the other or stationary arm, so as not only to lengthen the seat, so as to enable it to support a mattress or bed disposed on it, but to render the arm a foot guard for an infant or child placed on the said mattress or bed."

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12. For an *Improvement in Flying Horses;* Eliphalet S. Scripture, Greenpoint, Kings county, New York, June 4.

The patentee says,—"The nature of my invention consists in providing one or more mechanical horses upon a revolving platform, and in the centre erecting a series of cams around a centre post, and by hanging the horses at a point near the hip upon a centre, so as to admit of the head and forward part of the horses rising and falling, the before named centre serving as a fulcrum. I then connect, by levers, the forward part of the horse, so that the levers will come in contact, and be put in operation by a set or series of cams, each lever having a flexible connexion to the horses, and one after the other in succession, to be acted upon as the platform revolves, and thus by the rising and falling of the forward part of the horse, produces an undulating motion very nearly resembling the natural motion of a horse when galloping."

Claim.—"What I claim as my invention, is the combination and arrangement of the undulated cams with the levers, and these with the flexible connexions to the front part of the

horses, for the purpose of, and by which I produce the rising and falling motion, which I term the galloping motion, as herein before described."

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13. For an *Improvement in Electro-Magnetic Machines for Shocks;* Samuel B. Smith, City of New York, June 4.

Claim.—"What I claim, therefore, as my invention, is separating the shock derived from the initial secondary current of the double coil magneto-electric machine from that of the terminal secondary, by causing the latter to pass through a closed circuit, substantially in the manner and for the purposes set forth.

"I also claim the manner of adapting the same machine to transmit both the initial and terminal secondary currents at pleasure, by bearing off the spring by the arm, substantially as described."

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14. For *Improvements in Carding and Mixing Wool and Cotton;* Stephen H. Adams and John A. Wood, Cohoes, Albany county, New York, June 11.

The patentees say,—"The nature of our invention consists in mixing the wool and cotton together after they have been passed through separate pickers, and through two carding machines separately."

Claim.—"What we claim as our invention, is the picking and carding of the wool and cotton separate from each other, and the drawing them off together from the second carding machine, and then mixing their fibres with each other by means of the finishing or condensing card."

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15. For an *Improvement in Connecting Whiffletrees with Carriages;* James Barnes, Franklin, Delaware county, New York, June 11.

The patentee says,—"The nature of my invention consists in so connecting the whiffletrees to a carriage that, although I allow the required freedom of motion, I am enabled to guard against the danger which usually results from a trace breaking or becoming unhitched, viz: the end of the whiffletree to which a trace remains attached is drawn forward so far as to permit the horse to draw out of the shafts, and the contact with his legs also causes fright. By my improvement the whiffletree retains its appropriate position when only one trace remains attached to it."

Claim.—"What I claim as of my own invention, is the stops or blocks cast upon or otherwise affixed to the box, and the stops or blocks cast upon or affixed to the follower, in such manner that when the two are joined by a central bolt passing through, they will interlock and form a stop coupling, secure from derangement from external causes; the whole being constructed substantially in the manner described."

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16. For *Improvements in Hydraulic Apparatus for Producing Blast;* Ransom Cook, Saratoga Springs, Saratoga county, New York, June 11.

Claim.—"What I claim as my invention, is, 1st, the use and application of boxes, tubes, or cavities, attached to wheels, disks, or arms, by movable joints or journals, and then carried in a rotary direction alternately through air and water, said boxes or cavities moving at the same time on their own journals in such a manner that they shall enter the water with their open sides downwards, and when beneath the same shall empty or discharge the air which has been compressed within them by the water, into a receiver which is separate from such wheels and air boxes; all for the purpose of producing a blast or air to be used in heating, smelting, and other mechanical operations.

"2d, I also claim for this purpose the disk, recess, or concavity of the wheel, so as to allow the receiver to project over the mouths of the air boxes to receive their compressed air.

"3d, I also claim for the same purpose the cam, the cranks J J J, and the cranks K K K, attached to the air boxes, together with the piece on the open side of the boxes, the mouth for discharging their compressed air, and the block for throwing forward the cranks J J J."

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17. For a *Machine for Cutting Leather into Hollow-Ware Forms;* Richard E. Rabeau, Philadelphia, Pennsylvania, assignee of François Durand and Onesiphore Pecquer, Paris, France, June 11.

Claim.—"What we claim as new, is the combination of the vibrating knife with the fluted rollers, constructed and operating substantially in the manner and for the purpose fully set

forth, one of which rollers being fluted longitudinally, and the other circumferentially, serve firmly to hold the leather in any position."

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18. For a *Method of Forming Embankments, Levees, &c.;* Duff Green, Dalton, Murray county, Georgia, June 11.

The patentee says,—"My invention consists in conveying the earth from the site whence it is to be removed to the place where it is to be deposited, by means of a current of water caused to flow artificially in a trough or trench from the one place to the other with sufficient velocity to carry along with it the earth thrown therein, but which, when it arrives at the place of deposit, has its velocity sufficiently checked to be no longer capable of carrying along the earth, which is therefore deposited."

Claim.—"What I claim as my invention, is the method herein described of depositing earth to form embankments, levees, &c., and to fill up low situations, by means of filtering dams, or their equivalents, and a trough or conduit conveying earth and water from a higher level, substantially as specified."

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19. For an *Improvement in Adjusting Packing for Oil Boxes of Axles, &c.;* Warner Groat, Troy, New York, June 11.

The patentee says,—"In my improvement I employ a metallic band surrounding the packing, so that it shall be adjustable by a nut and screw (or any other convenient mode) from the upper side of the box, so that when the packing wears away it may be pressed to the journal, and rendered oil tight until it (the packing) is worn out."

Claim.—"What I claim as new, is the employment of an adjustable band surrounding the oil packing of railroad car or other journals, so as to admit of adjustment from the outside of the box, in adjusting the packing around the journal and render the box oil tight, in the manner and for the purpose substantially as herein described."

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20. For *Improvements in Cars for Plank Roads, Wooden Rails, &c.;* Gideon Morgan, Calhoun, McMinn county, Tennessee, June 11.

The patentee says,—"My invention consists in the mode of employing endless chains around proper guides for supporting and carrying a car or locomotive, and in the manner of keeping the chains tight, by which I obtain greater adhesion on the track, and a greater facility of draft on the car."

Claim.—"What I claim as my improvement, is the combination of a chain of rollers with broad bearing surfaces, running around a stationary rail or track on the carriage, with an independent chain which forms a track for said rollers to travel over when resting on the ground, and which passes around outside of said chain of rollers.

"I also claim the mode of constructing said track chain by lapping the links thereof, so that the rollers shall have a constant bearing on the three plates which form two succeeding links, and break joint with each other, as represented."

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21. For an *Improvement in Bedstead Fastenings;* Charles H. Parker, New Geneva, Fayette county, Pennsylvania, June 11.

The patentee says,—"My invention consists in a device by which the rails and posts of a bedstead are firmly united, and can yet be easily and quickly disconnected, while at the same time the mattress is strained. Also in a mattress constructed in such manner that its upper surface is more tightly strained than its lower, thus always affording a level support for the body of the sleeper, the weight of which, acting upon the rail fastening, tends to unite the posts and rails more securely together."

Claim.—"What I claim as new, is the device for securing the ends of the side rails to the posts, consisting of a headed tenon on the rail, and two wedge-shaped and dove-tailed boxes in the post, the latter held in place by the pendent arms and tie-rods, by which the mattress is stretched, substantially as herein set forth."

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22. For an *Improvement in Spring Mattresses;* William F. Ressegiue, Cincinnati, Ohio, June 11.

The patentee says,—"The nature of my invention consists in constructing the mattress, bed, or cushion, in such a manner that it can be used on either side, and folded or rolled up

whenever occasion may require; and the same can be stuffed with hair, moss, or any other suitable substance."

Claim.—"What I claim as my invention, is the construction of the jointed spring mattress, substantially as set forth."

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23. For an *Improvement in Threshing Machines;* Elisha S. Snyder, Charlestown, Jefferson county, Virginia, June 11.

The patentee says,—"The improvements that I have invented consist in making the threshing cylinder with curved wings inside the cylinder and moving with it, and so formed as to act as a fan, for the purpose of drawing the dust from the hopper wherein the feeder stands, and from the upper part of the machine, and blowing or forcing it out with the chaff, or through a suitable way formed in a convenient part of the machine, and for forcing currents of air through the spaces between the ordinary riddle and screen, to carry off the dust, chaff, and other filth mixed with the wheat, as the latter passes through the separator and riddle and over the screen, the air being drawn in at one end of the cylinder and forced out at the other end, and thence driven horizontally or obliquely, or in any required direction, through the separating and cleaning part of the machine.

"Also, in forming the concave, in which the cylinder revolves, of adjustive star or other shaped teeth, perforated in the centre, and strung upon rods secured in the timbers of the frame by nuts or other means, so that when a point or protuberance of any one of the teeth wears off or becomes broken, it can be turned on the rod and again secured by the nuts

"Likewise in forming a spring grating for separating the straw from the grain before passing on to the separator, and arranging the same in the space between the concave and the separator.

"Also, the manner of combining and arranging a rock shaft, arms, and connecting rod, for increasing or diminishing the motion of the shoe containing the separator.

"Also, the arrangement of a vibrating rack at the end of the separator, for throwing the straw off at the rear of the machine.

"Also, combining an elevator with the separator, for raising and dropping the grain, after leaving the screen, into an inclined spout, where it is subjected to the action of another current of air, by which the remaining dust is blown from it previous to its descent into the bag or receiver.

"And also, in the employment of a wire guard or screen, to prevent the entrance of straw, sticks, stones, and other extraneous matters into the centre of the cylinder."

Claim.—"What I claim as my invention, is surrounding the twisted wings with an imperforated case, and placing the same inside the threshing cylinder; the whole revolving together in the manner and for the purpose set forth.

"2d, Constructing the concave of adjustive star or other shaped teeth, attached to rods fastened to the frame, substantially as described.

"3d, Placing the curved spring rack between the concave of adjustive teeth and the vibrating separator, in the manner and for the purpose described."

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24. For an *Arrangement of Mirrors in Traps;* James Stevens, Middletown, Frederick county, Maryland, June 11.

The patentee says,—"My invention consists in a trap constructed in such a manner that the rat who looks at the bait shall see his own image reflected by a mirror in such a position as will lead him to believe that a second rat is endeavoring to get before him in seizing the bait; and when the first rat has been caught his image will also be reflected by a mirror, so that the next rat who shall look at the bait shall see two rats apparently striving to seize it, thus decoying him upon the turning floor, which yields to his weight and precipitates him into the body of the trap."

Claim.—"What I claim as new, is the arrangement of the mirrors, substantially in the manner and for the purpose set forth."

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25. For an *Improvement in Planes for Tongueing and Grooving Boards, &c.;* James A. Woodbury, Boston, Massachusetts, June 11.

Claim.—"What I claim as my invention in said apparatus, is the combination of a gouge or gouges, (for removing the bulk or greater portion of a shaving in forming tongues or grooves in boards or planks,) with smoothing tools having a chisel edge, a cutting or side lip on either or both sides thereof, (for smoothing the sides and bottom of the grooves, and the

edges about the tongues, as set forth,) said gouges being set in front of said smoothing tools, and the whole being arranged and operating substantially as set forth."

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26. For an *Improvement in Machines for Finishing Morocco;* Edward Bookhout and Henry Cochen, Jr., Williamsburg, Kings county, New York, June 18.

Claim.—"What we claim as our invention, is, 1st, a sliding head with finishing tools (one or more) attached, said tools to be held down by weights or springs; said sliding head to do its work while in a backward or forward motion, and running straight ways, as set forth.

"2d, We claim as our invention the application of one or more clasps for the purposes described, in combination with one or more finishing tools, whose motions are parallel with said clasps.

"We also claim the application of one or more finishing tools, which are held stationary while rubbing the skin or paper, and allowed to revolve a little when required to equalize the wear on the peripheries of the same."

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27. For an *Improvement in Spring Teeth of Hay Rakes;* Zephaniah Breed, Weare, Hillsborough county, New Hampshire, June 18.

The patentee says,—"The nature of my invention consists in applying the spiral spring in a way to form a self-supporting spring tooth."

Claim.—"What I claim as my invention, is the construction of the spring teeth of the hay rake of a double wire, in place of the single one generally used, as described."

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28. For an *Improvement in Attaching Neck-Yokes to Poles of Carriages;* James M. Brown, Bloomfield, Trumbull county, Ohio, June 18.

Claim.—"What I claim as my invention, is the mode described of constructing the neck-yoke, either solid or divided, and fitting the tongue or pole of the carriage, and these, so constructed and fitted, in combination with the movable band on which are projections or knobs, by which means the whole are securely connected, and thus form a universal joint for the purpose stated and not otherwise."

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29. For an *Improvement in Parlor Stoves;* Gardner Chilson, Boston, Massachusetts, June 18.

Claim.—"What I claim as new, is the arrangement of the flues in combination with the fire chamber, substantially in the manner and for the purposes set forth."

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30. For an *Improved Method of Making Nails by Rolling;* Elisha H. Collier, Scituate, Plymouth county, Massachusetts, June 18; patented in England, September 11, 1845.

Claim.—"What I claim as new, is the auxiliary furnace, in combination with the machinery for rolling nails, &c., as described, for retaining the heat of the plates or rods of iron while they are separately passed into the machine."

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31. For an *Improvement in Machines for Dressing Stone;* Robert Eastman, Concord, Merrimack county, New Hampshire, June 18.

Claim.—"What I claim as my invention, is dressing stone by means of chilled cast iron burrs, substantially as set forth."

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32. For an *Improvement in Furnaces for Calcining Gypsum;* Benjamin Fowler, Lubec, Washington county, Maine, June 18.

The patentee says,—"My improvement consists in constructing the apparatus with three chambers, (in addition to the pan or boiler commonly used,) so that each chamber may contain a charge, and all be heated at the same time by the fire in the furnace under the pan by means of tubes or pipes passing from the furnace upward through all the chambers.

"And in forming the bottoms or floors of the two upper chambers of beams or bars, brought to an edge at the top, and filling the intervening spaces with slides or movable valves, so that the charge may be readily let fall into the chamber next below.

"And in making the sides and bottom of the lower chamber in the form of inclined planes, (descending toward the door,) so that on opening the door the charge will readily run into the pan, or boiler, where it is to be finished in the common way."

Claim.—"What I claim as my invention, is the combination of the pan or boiler with the three chambers, when they are combined with the beams, slides, and dampers, when the whole is constructed, arranged, and combined, so as to operate substantially, according to the method, and to effect the purpose substantially as herein described."

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33. For an *Improved Spike Machine;* Ammi M. George, Nashua, Hillsborough county, New Hampshire, June 18.

The patentee says,—"My machine consists essentially of a revolving wheel containing the dies for griping and pointing the spike, acting in combination with a pair of knives for severing the spike rod, and a heading tool, by which the head of the spike is pressed into shape."

Claim.—"What I claim as new, is, 1st, the rising and falling guide and cutter frame in combination with a moving series of dies, whereby the spike rod is guided into the moving dies, and a slip of proper length cut off to form the spike, the knives being operated by levers which force them towards each other whenever the movement of the frame brings the levers in contact with stationary arms projected from the main frame.

"2d, The forked and hinged clamp, constructed substantially as set forth, in such a manner that when open, its inner fork performs the office of a gauge to regulate the length of the spike, and when closed, its outer fork gripes the shoulder of the spike during the heading, and its inner fork is withdrawn to allow the formation of the point.

"3d, The combination of the arm with the clamp and its tongue, by means of which the heading, griping, and pointing of the spike are effected, substantially as described, at one operation."

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34. For an *Improvement in Upright Piano Fortes;* Lemuel Gilbert, Boston, Massachusetts, June 18.

The patentee says,—"My first improvement is upon the frame of the piano, and is devised for the purpose of giving additional strength to said frame, so that it may more effectually resist the strain of the strings.

"My other improvements are in the action of the said upright pianos, and consist in the use of a regulating button on the key lever, which serves, by being altered from time to time, to keep the jack close to its work in throwing the hammer—also in connecting the back catch directly to the jack in part, and partly to the hammer butt; and lastly, in combining a regulating button, passing through the swinging part of the jack with the butt of the hammer, by which I am enabled to regulate the throwing off the hammer by throwing the jack out sooner or later after each blow."

Claim.—"What I claim as my invention, is, 1st, combining with each of the standards of the frame, a sustaining and strengthening rod, arranged in a curved groove in the back of said standards, and operating substantially as above described.

"2d, I claim connecting the stem to the rocker bar fastened to the key as described, and also to the horizontal arm on which the jack, &c., is supported—by which the whole action becomes attached to the key lever, and the hammer is made to return when the end of the key lever descends, all as set forth.

"I also claim combining the back catch with the fly of the jack as set forth, and in combination with a jack and back catch so arranged, the curved arm projecting from the hammer stem, and having a regulating button connected to said arm, as set forth.

"Lastly, I claim regulating the throwing off the hammer from the strings by the projection from the centre block of the hammer, and below its centre of action, in combination with a regulating button passing through the fly of the jack."

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35. For an *Improvement in Apparatus for Raising the Grate in Cooking Stoves;* Ira M. Mead, Mogadore, Summit county, Ohio, assignee of Benjamin K. Maltby, Cleveland, Cuyahoga county, Ohio, June 18.

Claim.—"What I claim as my invention, is the apparatus for lowering and raising the grate, so constructed as to act without liability to obstruction from the baking of ashes between the parts of the machinery, having sliding pieces or racks furnished with perforations instead of cogs, in combination with pinions acting upon them by cogs, said pinions having the spaces between the cogs beveled, bringing them to a kind of edge, thus admitting no flat spaces to intervene where ashes may accumulate to prevent the working of the machinery."

36. For *Devices for Moving and Holding a Piston Breech Pin;* William W. Marston, City of New York, June 18.

Claim.—"What I claim as new, is the arrangement of the parts described and shown, in which arrangement the radius bar is connected to the rear end of the sliding breech pin by a tenon and slot, taking a pin on the jaws at the rear end of the breech pin for the purposes of holding the breech pin in place while the charge is exploded, removing the breech pin to receive successive charges, and forcing the charge into the barrel by replacing the breech pin for the next successive discharges, the whole constructed, arranged, and acting substantially as described."

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37. For an *Improvement in Safety Stirrups;* Nathan Post, East Cleveland, Cuyahoga county, Ohio, June 18.

The patentee says,—"The nature of my invention consists in providing a safety bar, so arranged that in case the rider is thrown from his horse, the foot cannot hang in the stirrup."

Claim.—"What I claim as my invention, is the safety bar and the spring arranged in the form set forth, or in any other form, substantially the same in principle.

"2d, The arrangement of the loop cap by which I place the stirrup bars at right angles with the stirrup strap.

"3, The flat bar rising from the top of the loop to prevent the rolling of the stirrup in the strap."

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38. For an *Improvement in Feed Apparatus for Mills;* John Sherlock and William Brackbill, Portugal, Juniata county, Pennsylvania, June 18.

Claim.—"What I claim as new, is the feeding apparatus as above described, for keeping a regular supply constantly fed to the grinding surfaces."

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39. For an *Improvement in Apparatus for Parti-Coloring Yarn;* Alexander Smith, West Farms, Westchester county, New York, June 18.

The patentee says,—"In the method which I have invented for this purpose, the yarns to be partly colored are rolled around two rollers or reels, either fluted or made of wire, and placed one at each end of a frame. The journals of either one or both of the said reels working in slides connected with the frame. One or any number of these reel frames are then suspended to a vertically sliding frame operated by appropriate machinery, by means of which the reels with the yarns on them can be let down into a vat containing the dyeing or coloring liquor, the depth of immersion being indicated by a scale either marked on or suspended to the frame of the reels.

"After the required immersion the reel frames are removed, and either reversed to immerse the other end, or the reels turned to bring another part of the yarns in the proper position, depending on the pattern to be produced—and then again dipped in the same or another color. After the yarn has been immersed, the immersed reel is drawn up by the slide, that the rods or flutes of the reel may not be in contact with the yarn, which contact would have the effect of preventing the free access of the dyeing liquor to the entire surface of the yarn, and thus leave an imperfect color."

Claim.—"What I claim as my invention, is the method substantially as herein described, of parti-coloring yarns, by winding them on reels arranged in frames so constructed as to admit of immersing in dyeing liquor such portions of the yarn as are desired to be dyed, and shifting the same for dying other parts in like manner, substantially as described.

"And I also claim connecting one or both of the reels in each frame by means of slides, to admit of removing the reel from contact with the yarns whilst in the process of dyeing, substantially as specified."

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40. For an *Improvement in Mills for Grinding;* J. R. Stafford, Cleveland, Ohio, June 18.

The patentee says,—"The nature of my invention consists in combining a pair of crushing rollers, or a series of pairs of crushing rollers, acting, in conjunction with each other, with a disintegrator composed of a rapidly revolving cylinder or fanner, working in a suitable concave or casing in such a manner that grain or seeds conducted between the said rollers will be throughly crushed and broken thereby, and then will pass into the disintegrator, and be minutely disintegrated or pulverized during its passage through the same."

Claim.—"What I claim as my invention, is the combination of crushing rollers with a

disintegrating apparatus, arranged and operating substantially in the manner and for the purpose as herein set forth."

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41. For a *Combination of a Guide Tooth with an Inclined Scraper;* John F. Wood, Homer, Terre Bonne Parish, Louisiana, June 18.

Claim.—"What I claim as new, is the guiding tooth or revolving cutter combined with the inclined scraper, substantially as stated for regulating the course of the machine."

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42. For a *Model for Vessels;* Solomon Andrews, Perth Amboy, Middlesex county, New Jersey, June 25.

The patentee says,—"The object of my invention is to obtain increased speed for boats, by an endeavor to overcome certain difficulties arising from the necessary displacement of the water to float them, and the increased resistance from friction and inertia of the water caused by increase of speed.

"This I obtain by giving to the boat such a shape as will diminish its draft as the speed is accelerated, and as a consequence of this construction, I accomplish the injection of a small volume of air under the bottom, by the mere onward progression of the boat, and thereby still further reducing the friction of the water by diminishing the surface in actual contact."

Claim.—"What I claim as my invention, is the forming a vessel with a scow shaped bow, having on its sides two wide keels running the whole or a part of its entire length, and so constructed, that a portion of the inclined surface of the bottom shall always be above the water at the bow, and this with or without the supplementary keels forming small channels, by which construction air enters at the bow in the manner set forth, and is retained under the bottom of the vessel for certain purposes described herein."

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43. For *Improvements in Connecting and Disconnecting Hubs and Axles;* A. M. Billings and Thomas A. Ambrose, Claremont, Sullivan county, New Hampshire, June 25.

Claim.—"What we claim as our invention, is the method described of securely fastening the hub of a wheel to its axle, or easily detaching the same therefrom, to wit: by means of the two sliding plates combined with the double scroll shaped cam, in such a manner that by turning the said cam in one direction, the sliding plates will fasten the axle journal within the hub so securely that it cannot be unfastened by any jar, or shock upon the wheel; and by turning the said cam in an opposite direction, the sliding plates will be detached from their hold upon the axle journal and permit the wheel to be detached therefrom."

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44. For an *Improvement in Setting Artificial Teeth by Atmospheric Pressure;* John A. Cleveland, Charleston, South Carolina, June 25.

Claim.—"What I claim as new, is the air chamber constructed and arranged substantially as set forth, and for the purposes described."

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45. For *Improvements in Looms for Weaving Cut Pile Fabrics;* Mertoun C. Bryant, Lowell, Massachusetts, June 25.

Claim.—"What I claim as new is, 1st, the use in power looms for weaving cut pile fabrics of intersecting plates entering between the two pieces of cloth, and allowing the pile warps to cross and recross from one to the other, which extend through the reed, thereby forming on their upper surface a plane upon which one of the shuttles is supported in passing through the web, substantially as described.

"2d, The continuing of the intersecting plates to the outside of the warps by adding the within described false reed, or otherwise, for the purpose of supporting the ends of the intersecting plates, and for guiding the warps by them, substantially as described."

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46. For an *Improvement in Brick Presses;* Thomas Culbertson and George Scott, Philadelphia, Pennsylvania, June 25.

The patentees say,—"The first part of our invention consists in the application of artificial heat to the pressing and moulding surfaces, in the pressing and moulding of bricks, and other articles made of clay or of earthy compounds, of which clay is the chief ingredient made by moulding and pressing.

"The second part of our invention, which relates to the method of discharging the moulded bricks from moulds, arranged in a reciprocating carriage, consists of elevating the followers in the moulds by combining the carriage which carries the moulds with a secondary carriage or carriages, with rollers running on inclined ways, so arranged that, as the carriage of moulds approaches its running out motion on either side, it shall act on the secondary carriage which, by the continued motion of the main carriage, is carried up inclined ways, that in rising it may act on the followers of the moulds, to elevate them in a vertical direction only, instead of having an oblique action as heretofore, which tends to cant them in the moulds."

Claim.—"What we claim as our invention, is the method of preventing clay from adhering to the surfaces which make pressure on it, or in which it is pressed, or moulded by the application of artificial heat to such surfaces, substantially as herein described.

"And we also claim the method of elevating the followers of the moulds for discharging the bricks, by combining with the carriage of moulds, a platform, or carriage, which slides on inclined ways, and which receives motion from a carriage of moulds, substantially in the manner and for the purpose specified."

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47. For an *Improvement in Atmospheric Churns;* Peter F. Ellicott, Philadelphia, Pennsylvania, June 25.

The patentee says,—"The nature of my invention consists in placing in any ordinary vertical churn, or suitable vessel containing milk or cream, an upright hollow staff, and connecting said staff at the bottom with a square or round hollow plunger or dasher, and plunging on the inside of said staff a valve in such a position that, when the staff and plunger are raised, the valve will open and allow the atmospheric air to fill the dasher; and when said staff and dasher are forced down the valve will close, and the air in the dasher be driven out through the body of the milk or cream, and by the frequent movement up and down of said staff and dasher, in the churn, and through the cream or milk, butter will be formed."

Claim.—"What I claim as my invention, is a hollow staff connected with a square or round hollow plunger, with a valve placed at the top or at any point inside of said staff, said valve to be so arranged, that when the said staff and plunger are raised the valve will open, and when said staff and plunger are forced down, the valve will close, and the atmospheric air in the plunger will be forced through the body of the milk or cream, by which operation butter will be formed, said staff dasher and valve to be used in any vessel containing milk or cream."

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48. For an *Improvement in Electric Telegraphs;* George H. Horn, Boston, Massachusetts, June 25.

Claim.—"What I claim as my invention, is the above described new or improved electro-caustic telegraph, or application to telegraphic purposes, and substantially as specified, of heat generated by electric apparatus, or a current or currents of electricity passed through a fine platinum wire, or other proper conductors or equivalents therefor, as explained, the marks produced in or through the paper, or other material used in connexion with the heated wire, being regulated in their length and number, so as to be characters or expressions of letters, figures, or words, indicative of any message which it may be desirable to transmit from the battery end of the telegraph to the other end of the line; all essentially as set forth, or in the manner generally understood by telegraphic operators."

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49. For a *Machine for Forming Washers and Attaching them to Carpet Tacks;* Jason G. Howard, North Easton, Bristol county, Massachusetts, June 25.

Claim.—"What I claim as my invention, is the spring nippers arranged on a vibratory arm, and having a tapering bore, formed one-half in each of said nippers, for guiding the point of the tack to the centre of the washer. Also the combination of said nippers with the circular die and vertical moving punch, arranged and operating as set forth.

"I also claim a machine for preparing carpet tacks, consisting of the parts above stated, in connexion with an adjustable feeding motion, composed of the double endless bands, ratchet, and pawl, and parts which connect the same with the driving lever, as herein set forth."

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50. For an *Improvement in the Hinge of Rolling Iron Shutters;* A. Livingston Johnson, Baltimore, Maryland, June 25.

The patentee says,—"My invention consists in important improvements in that species of

hinge or joint which is formed by locking the edges of plates or sheets of metal, by curling them spirally within each other."

Claim.—"What I claim as new in constructing the hinges or joints of rolling iron shutters of thin slats of iron, is having a bar or wire inserted within the coiled edges of the joint or hinge, to give strength and stiffness to the joint, said bar having its ends bent, to prevent the several strips of iron composing the shutter from sliding laterally on each other, and the projecting bent ends of the wire being covered by ears projecting from the ends of the strips and turned down, thus forming an even edge to the shutter, which will slide easily in the groove of the frame in which it is placed; the whole being constructed substantially as described."

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51. For an *Improvement in Producing Photographic Pictures upon Transparent Media;* John A. Whipple and William B. Jones, Boston, Massachusetts, June 25.

The patentees say,—"The nature of our improvements consists in coating the surface of glass, or other suitable media, with a film of matter containing metallic and alkaline salts, the precipitation of which produces the various shades and tints of the picture to be taken."

Claim.—"What we claim as our invention, is, 1st, the taking of photographic pictures upon transparent media by coating them with some suitable vehicle for the sensitive materials, substantially as set forth.

"2d, We claim the process of using the sensitive coating or film upon surfaces, whether of transparent, translucent, or opaque bodies, substantially in the manner and for the purposes set forth."

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52. For an *Improvement in Cooking Stoves;* Abraham Keagy, Middle Woodbury, Bedford county, Pennsylvania, June 25.

The patentee says,—"My improvements consist in so constructing the stove that the flue instead of conducting the flame and hot air from the fire firstly round the back and under the bottom of the oven, and then either returning under the bottom and back, or else having to cross itself after passing over the top of the oven through a box, it makes the hot air, after passing to the back of the fire, to return between the fire chamber and the top of the oven, and thence round it, by the front, bottom and back, to the chimney, or, if required, it can be made to pass twice round the oven before entering the chimney."

Claim.—"What I claim is the combination of the flues with a single damper, so that, by a single movement, I cause the hot air to traverse once or twice entirely around the oven at pleasure, substantially as described."

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53. For an *Improved Arrangement of Sash Stopper;* Nathaniel Myers, Charlestown, and Frederick C. Smith, Harper's Ferry, Jefferson county, Virginia, June 25.

The patentees say,—"The nature of our improvements consists in placing an eccentric within the bar or stile of the window sash, in such manner that it shall be made to act upon and against a weather strip secured in a groove or channel formed in the bar of the sash, instead of against the frame or window casing."

Claim.—"What we claim as our invention, is placing the eccentric within the bar or stile of the window sash, in such manner as to act upon a weather strip instead of against the frame or casing of the window, the former being thereby firmly pressed against the latter and all defacement of the window frame by the eccentric avoided, as described.

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54. For an *Improvement in Mounting the Knife of Straw Cutters;* John R. Nelson, Knoxville, Knox county, Tennessee, June 25.

Claim.—"I claim, of the above arrangement, the placing of the pivot of the knife upon a spring, for the purpose of enabling the operator to give the knife a draw or sliding cut."

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55. For a *Machine for Repairing Roads;* Nathaniel Potter, East Hamburg, Erie county, New York, June 25.

The patentee says,—"The nature of my invention consists in a frame or carriage of timber of suitable strength and form, supported at its front end on a pair of wheels, which are mounted on a leading axle attached to the frame or carriage by a king-bolt, and supported at its back end by a broad roller extending across the entire width of the carriage, and having its axis working in suitable bushes or bearings in the frame or carriage. The said frame or carriage is provided near its front end with a pair of cutters nearly of the form of a quadrant,

which are fixed in nearly a horizontal position on a level with, or at any required height above or below, the track of the leading wheels. The said cutters are for the purpose of cutting off the ridges of dirt at the sides of ruts formed in roads, and have a tendency to throw the earth so cut off into the rut."

Claim.—"What I claim as new, is hanging the cutters for cutting off the ridges at the sides of the ruts, the scrapers for scraping the dirt into the ruts, and the roller for pressing and smoothing the road, upon the same frame; all the said parts operating together in the manner and for the purposes substantially as herein set forth."

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56. For an *Improvement in the Weed Cutters of a Cultivator;* Charles Rodger, Montpelier, Washington county, Vermont, June 25.

Claim.—"I claim the combination of the bar with the weed cutter, in the manner and for the purpose set forth."

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57. For an *Improvement in Water Wheels, for Increasing or Diminishing their Diameters;* T. R. Timby, Cato Four Corners, Cayuga county, New York, June 25.

The patentee says,—"My improvements are, 1st, adjustable arms, by which the buckets or hands, as I denominate them, are expanded from, or contracted towards, the water, by means of which I can, with the same elements, form a wheel of any desired diameter to suit the head of water, the machinery or gearing to be driven and the amount of labor required to be performed.

"2d, The buckets are formed on a novel principle of construction for direct acting water wheels, by which I obtain the greatest effect from the impinging of the water thereupon."

Claim.—"What I claim as new, is the double adjustable arm, constructed as above described, for expanding or contracting the size of the wheel, for the above specific purpose, so that the absolute diameter of the wheel and arms shall be reduced or expanded to go within a suitable curve."

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58. For an *Improvement in Self-Acting Cheese Presses;* John Underwood, Montpelier, Washington county, Vermont, June 25.

Claim.—"What I claim as my invention, is the arrangement of the rollers and wedges, in combination with the inclined planes, acting in the manner and for the purpose set forth, to produce a sufficient pressure upon the cheese or other article to be pressed."

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59. For an *Improvement in Boot-Trees;* William Upfield, Lancaster, Fairfield county, Ohio, June 25.

Claim.—"What I claim as my invention, is the combination of the sliding wedges, and the right and left screws, with the inclined planes or grooves C C, substantially in the manner and for the purpose set forth; the screws being made to play within the groove D, and being confined to its place longitudinally by the bar working in the groove H."

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60. For an *Improvement in Carriages;* Miles S. Watkins, Somerville, Fayette county, Tennessee, June 25.

Claim.—"What I claim as my invention, is the combination of the open elliptical axletree with the sliding slotted frame attached to the body of the vehicle, and passing through the upper half of the axletree, and attached to the upper leaf of the elliptical spring placed inside of the axletree, the lower leaf of said spring being secured to the inner side of the lower half of the axletree; the several parts being arranged and operating in the manner and for the purpose set forth."

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61. For an *Improvement in Waste Gates;* Hiram Yaw, Boston, Erie county, and Thomas P. How, Buffalo, New York, June 25.

The patentees say,—"The nature of our invention consists in providing mill ponds, canals, and reservoirs, with a waste gate hung upon a vertical axis, the lower part of which is made wider one side of the axis than it is the other, the side which is narrowest towards the bottom of the gate being sufficiently wider than the other towards the top that the balance of the pressure of the water will change from one side of the axis to the other, and open and close the gate as the water rises and falls."

Claim.—"What we claim as our invention, is a waste gate which is hung upon a vertical

axis, the lower part of which is made wider one side of the axis than it is the other, the side which is narrowest towards the bottom of the gate being sufficiently wider than the other towards the top, that the balance of the pressure of the water will change from one side of the axis to the other, and open and close the gate as the water rises and falls."

RE-ISSUE FOR JUNE, 1850.

1. For an *Improvement in the Machine for Boiling and Washing Rags for Manufacturing Paper;* John Campbell, City of New York, assignee of George Spafford, Windham, Windham county, Connecticut; patented September 2, 1840, re-issued June 11, 1850.

The patentee says,—"The invention consists in digesting with an alkaline or other liquid, in a close turning vessel, the rags or other fibrous materials for making paper pulp, the heat being applied to the exterior of the vessel, or by steam introduced within it, as may be deemed most expedient."

Claim.—"What is claimed, is the herein before described process of preparing materials for making pulp in the manufacture of paper, by digesting them in a turning vessel with an alkaline solution or other liquid, the heat being applied to the outside of the vessel, or by steam introduced within it, substantially as set forth."

DESIGNS FOR JULY, 1850.

1. For a *Design for Umbrella Stands;* Walter Bryent, Boston, Massachusetts, June 4.

Claim.—"What I claim as my production, in the new design for an umbrella stand, consisting of branches of a grape or rustic vine cast in a twisted form about the basin, and then rising vertically and crossing each other to form the stem, from which other branches project horizontally, and are turned so as to form the loop holes, all as set forth."

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2. For a *Design for Coal Stoves;* John T. Davy, Troy, New York, June 4.

The patentee says,—"My design consists of arabesque ornaments; the stove is square, each side and the back being the same in form and figure as the front represented, excepting the sides are made whole instead of a door as at *a*, the back having a pipe hole situated in the panel *a*."

Claim.—"What I claim as new, is the ornamental design and configuration of stove, substantially the same as herein described and represented."

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3. For a *Design for Stoves;* Amos Paul, South New Market, Rockingham county, New Hampshire, June 11.

Claim.—"What I claim as my invention, is the combination of the bull's eyes in alto relievo, (having radial notches as described,) and of alternating concave and convex radial ribs and surrounding mouldings on the several doors and panels of the front and side plates, and the row of pointed leaves, and of alternate notches and ridges, on the moulding of the hearth plate, all as set forth."

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4. For a *Design for Stoves;* E. P. Penniman, Rochester, New York, June 18.

Claim.—"What I claim as my production, is the combination of the four ornamental figures, as represented."

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5. For a *Design for Stoves;* John F. Rathbone, Albany, New York, June 18.

Claim.—"What I claim as my production, is the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a parlor stove."

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6. For a *Design for Stoves;* John F. Rathbone, Albany, New York, June 18.

Claim.—"What I claim as my production, is the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

7. For a *Design for Stoves;* James Wager, David Pratt, and Volney Richmond, Troy, New York, June 18.

Claim.—"What we claim as new, is the ornamental design and configuration of the plates, as described and represented."

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8. For a *Design for Stoves;* Job E. Owens, Jacob Ebert, and Elbridge G. Dyer, Hamilton, Butler county, Ohio, June 25.

Claim.—"What we claim as new, is the combined ornamental design and configuration of plates for a cooking stove, substantially as herein set forth."

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9. For a *Design for Stoves;* Washburn Race, Seneca Falls, Seneca county, New York, June 25.

Claim.—"What I claim as my invention, is the design of the top and bottom stove plates, represented in the accompanying drawings, and herein set forth."

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10. For a *Design for Cooking Stoves;* William L. Sanderson, Troy, New York, June 25.

Claim.—"What I claim is the design and configuration of cook stove, as described and represented in the annexed drawings."

MECHANICS, PHYSICS, AND CHEMISTRY.

To the Committee on Publications of the Franklin Institute.

Description of the Solar Magnetic Engine, invented by Wm. W. Hubbell, Esq., *Philadelphia.*

Gentlemen:—Herewith you will receive a correct copy of my specification of the "Solar Magnetic Engine." The leading feature in the invention is the solar magnet, one of which, (Fig. 1st and 2d,) now in my possession, and embodying much power, was used by me, experimentally, as early as December 22d, 1841. Caveat papers, then executed and retained by me, show that this system of magnetic powers was known to me at or before that time.

The organization of the engine is the development of the system, of which the solar magnet is the controlling centre or foundation. Without it the system of powers could not exist.

Wm. W. Hubbell,
Att'y and Counsellor at Law, &c.

Philadelphia, July 24, 1850.

Copy of Specification.

Magnetism I believe to be a fluid which pervades all material things, though in different degrees, and that it will pervade soft iron and steel to the greatest degree. It has two qualities within its nature—a positive and a negative; which in different bodies attract each other, while each seeks to diverge from its kind in different bodies by repulsion. Positive magnetism, or that of the North Pole, results from the zinc portion of a galvanic battery; and negative magnetism, or that of the South Pole, results from the copper or iron portion of a galvanic battery. The pro-

duction of magnetism by a galvanic battery, called electro-magnetism, is common, and the method well known at the present day.

In order to enable others skilled in the art to make and use my solar engine, I will proceed to describe its construction and operation, reference being had to the annexed drawings, making together with the written descriptions thereon, accompanying Figures 3d, 4th, 5th, and 6th, Plate I, a part of this specification, and on which like letters refer to like parts hereafter explained.

The principle or character of my invention is based upon principles which I have deemed as a guide in developing my invention, to exist in the solar system of the universe; and being intended by me, so far as may be necessary to obtain an organized mechanical power and motion, as an imitation of the solar system, I have thought proper for elucidative purposes, to designate my invention the "Solar Magnetic Engine." Its nature is based in imitation as follows: I suppose the sun or centre of the system to be possessed of the magnetic principles of attraction and repulsion, and exercising these influences at every point of an unbroken circumference around a common centre or axis; its face possessing equal capacity of power at any circumferential, with any other parallel circumferential point, to attract direct to, and repel directly from this common axis or centre.

I therefore construct a centre or solar magnet to embody within its own nature these aforesaid principles. This magnet, with the variable modes that have occurred to me of constructing it, are hereinafter described.

To imitate the planets revolving about, and governed by the sun and each other, as far as, for my purpose of attaining available power in machinery is necessary, I have one, two, three, eighteen, or fifty, more or less than two magnets vested with attractive and repulsive power, and playing about and governed by a common centre not coincident with the centre of the solar magnet, but so fixed near it, that these planetary magnets, by mutual attraction between each of them and the solar magnet, approach from their aphelion or farthest point of recedure, to their perihelion or nearest point of approach to the solar magnetic surface, and then by changing their poles relatively to this surface, when, or as they successively reach the nearest point of approach, they of the planetary and the solar magnet repel each other, until the receding planetary magnets respectively arrive again at their aphelion or point of farthest recedure, where their poles again rechange, and they of the planetary and the solar magnet attract each other, and thus the planetary magnets successively change at their points of aphelion and perihelion, and approach near to, and recede from, and revolve around the solar magnet; which solar magnet, at its every circumferential point, exerts its power on the revolving planetary magnets; and as within itself, owing to its formation, it concentrates and embodies, to and from its common centre, a great and uniform capacity of attractive and repulsive nature, so also when combined with the planetary magnets, it developes an uniform and continuous power for practical use, as an universally appropriative power.

With regard to the solar magnet, reference being had to figures 1st and 2d, it is constructed as follows: Figures 1st, 3d, 4th, and 9th are each a sectional view of different solar magnets, on a line extending longitudinally through the centre or diameter of the engine; figures 1st and 9th also

showing some of the planetary magnets. It (the solar magnet) may be said to be a continuously circular horse-shoe magnet, or to consist of two circular plates (AA AA) joined in the centre or at the inner circle (BB) by a circular back, column, or cylinder (CC), either solid or hollow; or the two circular plates may be joined at the outer or largest circumferential surface (as in fig. 3d) by a circular ring, cylinder, or back; or as in fig. 4th, the magnet may have both an inner and an outer circumferential surface (DDDD DDDD) formed by connecting the two circular plates (AA AA), about midway between these surfaces, by a circular ring, cylinder, or back (CC); this magnet will then be a combination of the one in fig. 1st and 2d, and the one in fig. 3d; or another mode to combine them is to have them separate as first described, yet the one fig. 3d so small, and the one fig. 1st and 2d so large, that the former will set within the circuit of the back of the latter, and thus they, back to back, with or without a wood cylinder, or other non-conducting substance between them, will be effectively combined; or the latter may set within the former, face to face, as in figures 5th and 6th, and the planetary magnets approach and recede as indicated by their respective paths EE and EE; or they may further be combined as is expressed in figures 4th and 3d of the drawings. The solar magnet may consist of solid wrought or cast iron, or steel, or may be made of numerous thin plates of iron or steel (or other suitable metal) riveted, or screwed, or bolted, or otherwise secured together, or it may be made of soft wrought iron or steel strips, or wire, having the ends thereof to terminate and form the circumferential or magnetic surfaces of the magnet. The number of pieces of wire in this case must be very great, and each one bent to suit and construct the horse-shoe form of the solar magnet. I deem it best made of plates; and when the solar magnet is made of numerous pieces of thin plate or wire, each piece may be cut or spread of the shape displayed by figure 7th, the dotted lines (XX) indicating where it is bent to form the poles; of course, in this case the smaller pieces form the inside of the poles and the outside of the connecting cylinder or back in fig. 1st and 2d, and the inside in fig. 3d, and each succeeding piece must be as much longer than this as the thickness of the plate requires to make it fit to the former; and also the pieces forming each succeeding layer should be set over the junctures of the pieces forming the preceding layer, as in fig. 8th; a coil of the covered wire from the batteries may be put between each layer or between every second or third layer of plate or wire, to more effectually magnetize the said solar magnet. In the solar magnet, one circular end becomes a north pole, and the other one becomes a south pole; and the strongest magnetic power exists around the circumferential surfaces, and acts convergently and divergently to and from the common centre of the circle. This solar magnet may be either a permanent or an electro-magnet; when permanent, it should be of steel and be packed inside at the central part (F) and between the poles (GG) with loadstone, or it may be of wrought or cast iron, steel, or other material, and magnetized by means of a galvanic battery or batteries, in which case the coils of the covered wire should be wrapped in the space between the poles, both inside and outside of the cylinder or back, and also a coil or coils should be laid on the side of each pole (AA), thus and always covering the magnet with coils of covered wire as numerously, as heavily,

and at every part, except the circumferential faces, as much as possible; and thereby giving those faces the greatest magnetic power.

And now as to the construction of the solar engine: I affix the solar magnet to a strong wooden (mahogany, maple, or oak, &c.) or suitable metallic base, (H fig. 1st, or H fig. 3d, or H fig. 4th,) the point I being the centre of this solar magnet; and around this solar magnet's magnetic surfaces I arrange the planetary magnets (KK, 50 more or less in number, figs. 1st and 2d); these are best made of numerous pieces of porous, soft, wrought iron wire, or they may be solid, and of the ordinary horse-shoe form, or they may be straight; their ends, heads, or faces towards the solar magnet, may present the inverse or converse curve of its faces, or be straight-faced, or rounded; the inverse or converse is the best; the breadth of their faces should be about the same as that of and directly opposite the faces of the solar magnet, and each magnet must be separate and distinct from the others; in this way they must be attached to a revolving frame, or cylinder, governed by its own independent centre or shaft (L), and this centre be near the solar centre (I), as in fig. 2d, so that the planetary magnets, as they revolve around the solar magnet, may successively approach as near as possible, without contact, to its faces; and then may recede from its faces to nearly the utmost extent of its influence. The modes of suspending or securing central shafts and bases, thus relatively to each other, are numerous, and well known to machinists. I have in the drawing shown the shaft suspended vertically, as I deem that the best relative construction for the engine, and have rested the planetary shaft on the central column, or base which sustains the solar magnet, and rests on the general engine base (M). I have sprung a metallic arch or beam resting on columns, over the engine, and resting on the general base, for the purpose of receiving the upper end of the planetary shaft (L), and also to hold the charging keys of the planetary magnets (KK *et al.*) The appropriative power of the engine can be taken from the upper part of this planetary shaft by cog-wheels, pulley-wheels, or any of the known means.

The beam, columns, and base, whenever the bulk is not material, are best made of wood, such as mahogany, maple, oak, &c.; so also the planetary frame is best made of wood. The engine may also be suspended horizontally, in which case the planetary shaft may rest on an oak or other wooden frame, on each side of the solar magnet; this any mechanic will know how to construct in numerous ways, without directions from me.

The number of engines may also be increased to two, four, ten, or any other number on the same shaft, the shaft being either vertical or horizontal, and the engines either above or horizontal to each other; or each engine may rest on its own shaft, and their power be concentrated on a single shaft by means of cog-wheels, pulley-wheels, or any of the known means of communicating power. One excellent method is to set numerous engines immediately under the circumference of a large cog-wheel, with a cog-wheel from the upper part of the shaft of each engine running in gear with it, and thus they all concentrate their power into it. Another is, to set them under a horizontal shaft, and each give its power to it by means of a bevel cog-wheel on the planetary shaft, and another on the horizontal shaft.

Each of the planetary magnets should be secured between two wooden

rings, or otherwise, to the revolving frame, or series of arms, or cylinder (NN), and each of these magnets is wrapped with covered wire to magnetize it from a battery; which wires (UUUU) are led to near the planetary shaft (L), where they are held in and by slots cut through a wooden ring, and those from the positive poles are in contact with positive semi-circuit keys, and those from the negative poles are in contact with negative semi-circuit keys. It is well known that the positive pole or semi-circuit key can be made negative, and *vice versâ*, by simply changing the wires from the one to the other nature of the battery. These semi-circuits (OO OO) around the planetary centre are four in number, are stationary with the arch or beam, and form two circuits, each having two breaks (QQ QQ), the one semi of each being positive, and the other negative; the one break where the poles change is opposite the perihelion or nearest point of approach to, and the other break is opposite the aphelion or point of farthest recedure from the solar magnet. The breaks consist of ivory, or other non-conducting substance; and as the wires from the planetary magnets, in revolving with their respective magnets, pass from one semi-circuit on to the other, either by platina or other metallic wheels on them, rolling in contact with the circuits, which is the best mode; or by having platina, or other metallic ends, which slide around against the circuits, they respectively cause their respective magnets to change from positive to negative, and *vice versâ*, end for end; and thus the planetary magnets continuously approach the solar magnet by attraction, and recede from it by repulsion, being continually under its influence and revolving around it. It is evident that, in their approach to the solar magnet, they may not be magnetized, as it will attract them; but I deem it best to magnetize them at this time, as well as necessary on their recedure. Copper wire, covered with cotton or other substance of a non-conducting nature, is usually employed to wrap magnets, in order to magnetize them by a galvanic battery. Any suitable covered wire may be employed in this engine, and wherever the charging keys and planetary wires are in a state of friction, platina is the best metal to use, as it will not readily oxidize; this fact is already well known in the art; therefore the semi-circuits of the charging keys (excepting the ivory breaks) are best made of platina, also the ends of the planetary wires, and the little friction wheels that run on them and bear against the keys, are best made of platina.

To charge the planetary magnets as heavily as possible, each pair of opposite magnets should have their own circuits of keys, in which case the circuits may be very small and above each other, and each charged by a separate battery; or, if this is not done, it is best to make as many conducting wire connexions, to and at equal distances along the circuit of the charging keys, as there are planetary magnets, in order to distribute the fluid and magnetize them effectively.

The revolution or the motion of the engine may be reversed, by mutually changing the wires of either the solar or planetary magnets in the battery. This may also be done by a simple lever with sliding conducting attachments, or in numerous ways.

In the engine having its solar magnet's face on the inner circle, as in fig. 3d, it will of course be seen that the planetary magnets are inside of its faces or circle; whilst with the solar magnet, as in fig. 1st and 2d,

having its faces on the outside of the circle, the planetary magnets must revolve outside of the face of the solar magnet; and with the solar magnet, having both the inside and outside circumferential faces, as in fig. 4th, there must be two series of planetary magnets, the one to revolve inside, and the other outside. And also, when the solar magnet fig. 1st and 2d is combined inside of the solar magnet fig. 4th, and at the same time the solar magnet fig. 3d is combined outside of fig. 4th, these two series of planetary magnets have the whole attractive and repulsive power of these four solar faces thrown on them, to furnish appropriative power to the engine. When numerous series of planetary magnets are employed, presenting themselves to different solar faces, each series of planetary magnets should have its polar ends let into, and should stand between, two wooden rings or cylinders, having arms connecting them between the magnets, and extending from both series to a hub, by which they concentrate their power in its, their common centre or shaft, as the appropriative power of the engine. The heads or polar ends of the planetary magnets may have their faces curved, coincident with the inner and outer curves or circles of the rings holding them; and the straight magnets, having their heads or polar ends enlarged each side of the coils of wire, are best to present their faces to these combined solar surfaces.

In this system of magnetic machinery, the planetary path (EE) in figs. 5th and 6th respectively, by way of variable capacity, may be considered as composed of covered brass, or copper tracks, or electro-magnetic wires, conductors, or keys, the one half between the aphelion and perihelion, on the one side of the solar magnet, separated from the other half between the perihelion and aphelion, on the other side of the solar magnet, by ivory or other non-conducting substance; and one of the planetary magnets (E) be a conical wheel or rolling ball of soft wrought iron; the said keys being one positively and the other negatively charged. In this case, the balls or wheels will be continuously changing from positive to negative, and *vice versâ*, as they pass the points of aphelion and perihelion, and thus run or roll around the solar magnet. In this instance, the planetary path need not be perfectly circular, but may be similar to the orbits of the planets, and the number of planetary magnets, wheels, or balls, with their respective paths or orbits, may be increased to any such number as the face, or size of the solar magnet, will admit of presentation to it. This variable capacity of the system, it will be perceived, is not so well calculated to give appropriative power, as where the power is imparted to the central shaft (L), as described, which may in this case also be done by coupling the two balls, by means of a wire running through the shaft (L), jointed if the path be an orbit, or not jointed if it be circular.

Another variable mode of employing the solar magnetic principle, or character, is displayed by fig. 9th. This variable mode consists in providing the solar magnet with eight circular faces, two faces to each pole (AA AA AA AA), so as to present four series of planetary magnets (KK KK KK KK), each series consisting of as many magnets as can be presented to the solar circuits or faces, to act in concert with them. This solar magnet has its four poles (PP NN PP NN), converging and diverging to and from its centre, and also the same poles diverging longitudinally.

Between the poles are wooden diaphragms (ZZ ZZ ZZ ZZ), to separate

the negative and positive coils of wire that magnetize it, by means of the galvanic batteries; the letters P, between the poles, denote the positions of the coils of wire positively charged, while the letters N denote the coils negatively charged, and the letters P, on the poles, denote the positive poles, while the letters N, on the poles, denote the negative poles. By changing the wires from positive to negative, and of course *vice versâ*, these poles change in like manner.

This solar magnet is, of course, continuously circular; fig. 10th is a side view of it. When the four series of planetary magnets (KK *et al.*) are presented to it, a cylindrical base (M) supports it, and the lower series of planetary magnets revolves inside of the cylinder base. This lower series of magnets may be dispensed with, losing however its effective power; and, in that case, the lower diaphragm may be extended down, and form the cylinder base; or the lower side of the solar magnet may rest on a flat wooden base. The series of planetary magnets within and outside of the circuit of the solar faces, approach and recede the same as those in the other figures; and the upper and lower series of planetary magnets approach and recede as they revolve about the solar faces, by the planes of their revolution being at acute angles (⌖⌖) respectively, with the planes of the solar faces, or the side solar faces, caused by inclining their respective axles, or shafts, on which they revolve.

These axles are stationary, and sustain the shaft (L) of the inner and outer series of planetary magnets, and the hub or centre of the upper and lower series rests and moves on friction rollers; the said axles or shafts may also be made to revolve with them, by toggle-joints or bevel cog-wheels connecting them to the central shaft (L).

These series of planetary magnets change their poles at the points of perihelion, or nearest approach, and aphelion, or farthest recedure, as they revolve around or about the solar faces, similar in mode or principle to those presented to the other solar magnetic faces.

It will be apparent to any person, from this specification, that the number of solar magnets, and that the number of series of planetary magnets to constitute a single engine, may be increased to any extent, on the system herein set forth. Also that the solar magnets may be slightly changed in form, and still preserve the same distinctive principle or character; for example—the poles of solar magnet fig. 1st, fig. 3d, fig. 4th, respectively, instead of extending parallel to each other, may converge or approach each other, and thus resemble more minutely the horse-shoe curve; in this case, each pole, instead of presenting the form of a plane ring, would be the frustrum of a cone, or, if with a curved side, the segment of a hollow sphere. The planetary magnets may also be slightly modified in form, still observing the general principles here laid down, in their relation to the solar magnet or magnets.

And various modes, the principle of which is well known, for wrapping the horse-shoe magnets, may be employed for wrapping the solar magnets with the covered wire, to charge them as highly with magnetism as possible. The ordinary magnets are found to be most highly charged by wrapping each pole with several series of coils, the positive being the proximate or commencing wire for one pole, while the negative is for the other; I apply this system to the solar magnets. And I wrap the positive portion on one

The "Solar Magnetic Engine," invented by William

Fig. 1.

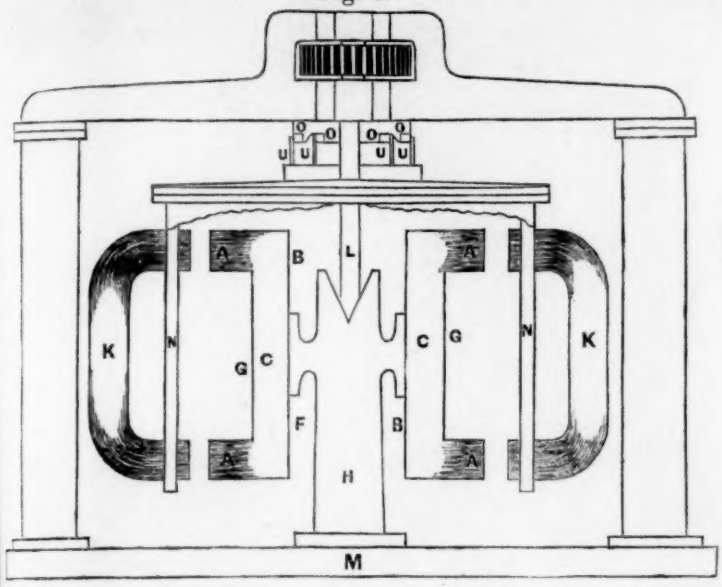


Fig. 2.

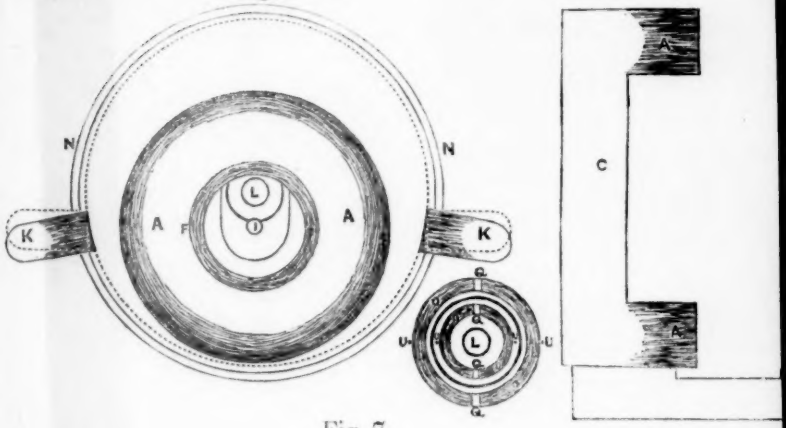


Fig. 7.

Fig. 8.

Fig. 9.

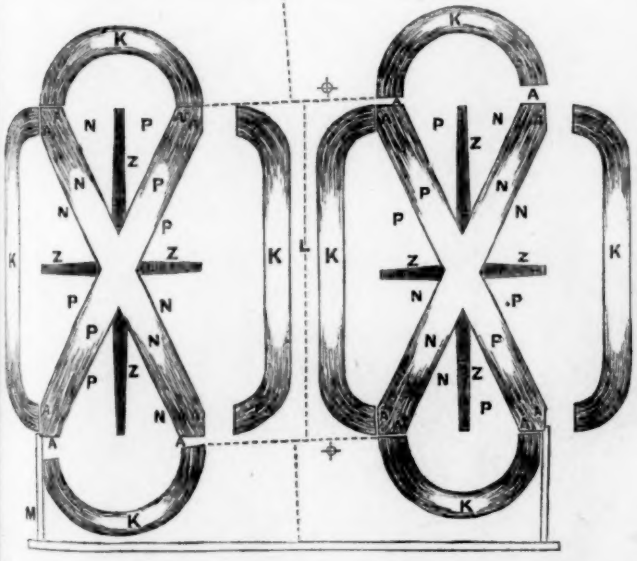
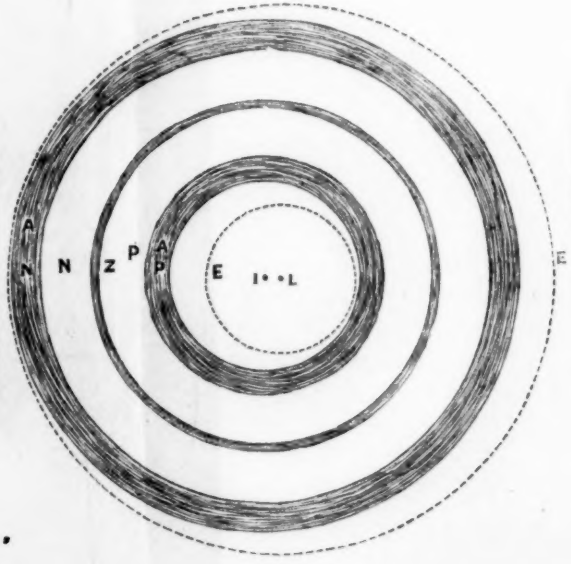


Fig. 10.



r Magnetic Engine," invented by William W. Hubbell, Esq., Philadelphia.

Fig. 2.

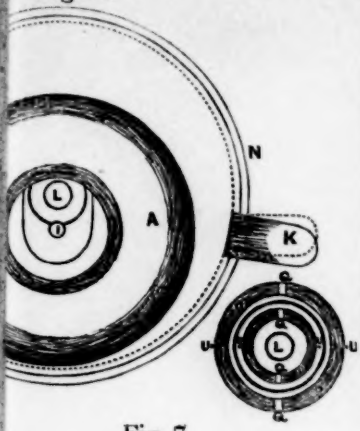


Fig. 3.

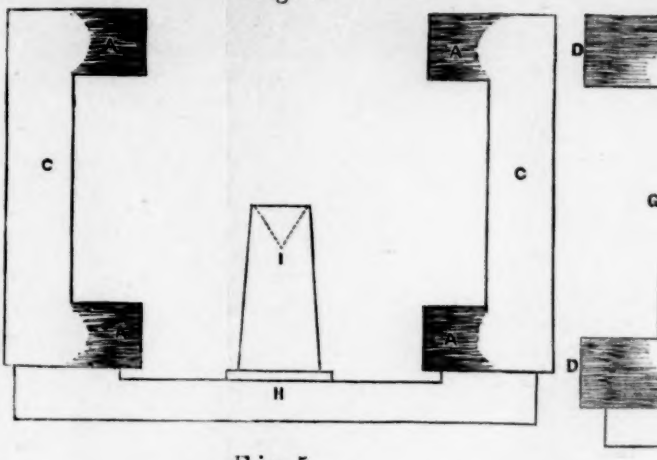
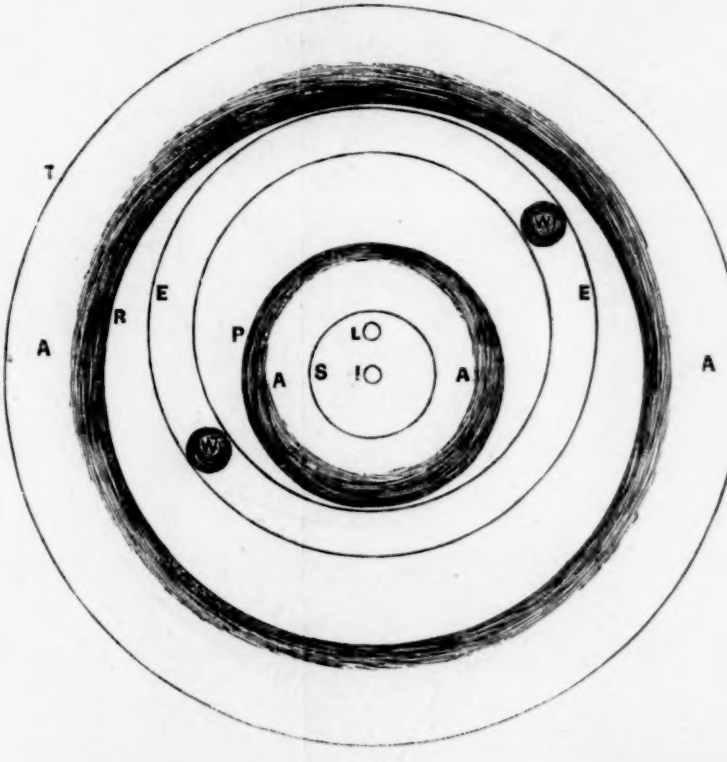


Fig. 7.

Fig. 5.



10.

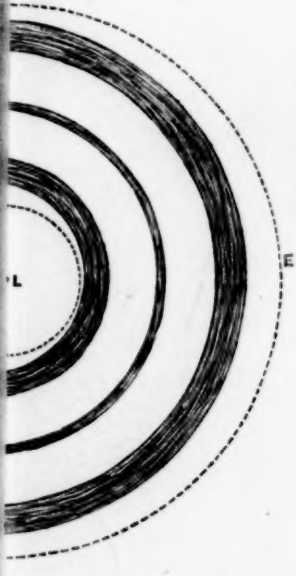


Fig. 4.

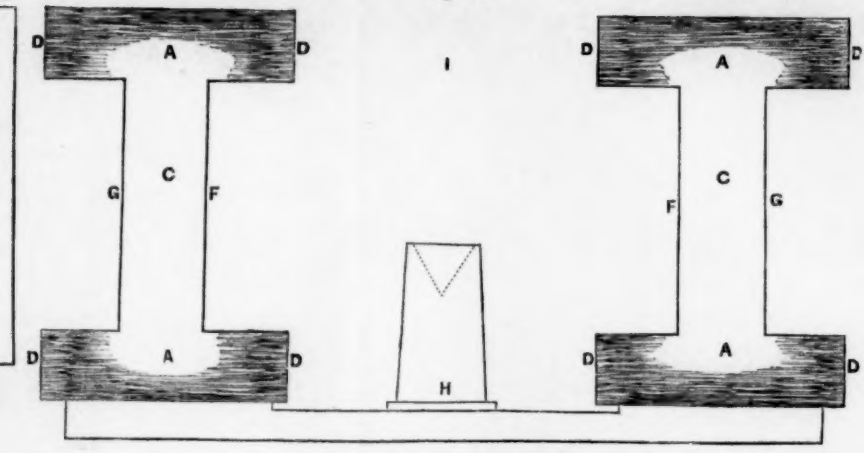
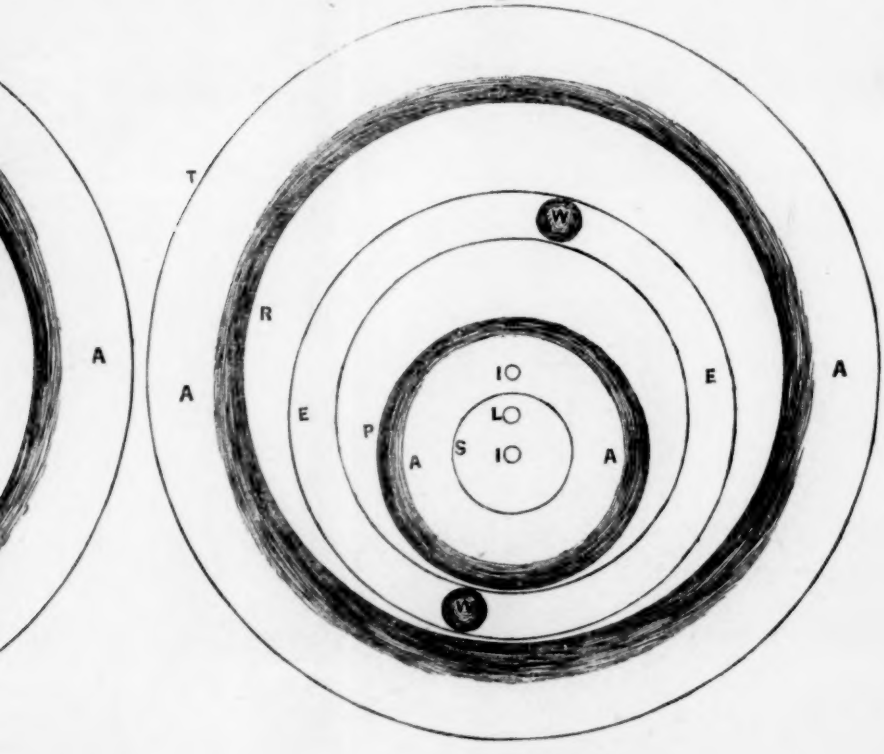


Fig. 6.



side of a wooden or other suitable diaphragm, and the negative on the other side, carrying the wires from one to the other nature, through the diaphragm, when and as I wrap numerous series of coils, the one over the other successively, and also when side by side. The diaphragm may be dispensed with, but it allows a greater body of wire to be coiled when desired *without contact;* and, if desired, still a greater body can be coiled with the positive and negative *not distinctively separated,* by dispensing with the diaphragm. I carry the positive and negative wire of each series of coils respectively, through an ivory bush let into the respective side of the solar magnet, by which the wires do not interfere with the faces of the solar magnet, and they charge it heavily with magnetism. The upper wires are generally led over the upper side, on a wooden flanch or ring, (two of which hold the outside coils in contact with the outer sides of the poles respectively,) until they reach near the centre of the solar magnet, where they are led down through its supporting wooden column, or, if metal, through an ivory bush, and, together with the lower wires, are attached to their respective poles or natures of the galvanic battery. To charge the solar magnet or magnets heavily, and thus make them most efficient, the galvanic battery or batteries should always be used; and the planetary magnets, owing to their change of poles at the points of aphelion and perihelion, should always be electro-magnets, or made magnetic by means of the galvanic batteries.

Having fully described the principle, or character, of my invention, so as to enable any mechanic, of ordinary ability, and skill, to understand its nature, and to construct and use the same, I wish it to be understood, that, as respects the planetary magnets in their separate natures, I do not claim them; they being only the ordinary and well known kind of magnets. But, I do claim to be the original and first inventor of the solar magnet, in its principle, or character, and the various modes of constructing it, herein set forth.

I also claim the mode of combining, or placing, any, or all, of said solar magnets relatively with each other, or together, as described.

I also claim the combination of the engines described, on the same shaft, or around the cog-wheel, or with the horizontal shaft, to which they unitedly impart their power, as described.

And finally, I claim the application of the planetary magnets, to revolve around, or about, the solar magnet or magnets, substantially, in the manner, and on the principles, herein described.

WM. W. HUBBELL.

Additional Explanation of Plate I.

Figure 4th. The solar magnet fig. 1st and 2d may set within this one, and thus have three solar faces acting on two series of planetary magnets, the inner series as in fig. 5th or 6th, and the outer series as in fig. 1st and 2d, both series affixed to the same shaft.

Figure 3d. This formation of solar magnet may set outside of the form fig. 4th, and thus have *four* solar faces acting on two series of planetary magnets; this, fig. 3d, being relative to the planetary path, either as the outer magnet in fig. 5th, or as the outer magnet in fig. 6th.

Figure 5th. L is the centre of the planetary magnets' path EE. AA of the inner solar magnet is the north pole, while AA of the outer solar magnet is the south pole, and *vice versâ*. I is their centre. P is the face, and S the back of the inner solar magnet. R is the face, and T the back of the outer solar magnet. W W are two of the planetary magnets, of which EE is the path.

Figure 6th. L is the centre of the planetary magnets' path EE. AA of the inner, and also AA of the outer solar magnet, are both either north or else south poles at the same time. I I are their respective centres. S is the back, and P the face of the inner solar magnet; and T is the back, and R the face of the outer solar magnet. W W are two of the planetary magnets, of which EE is the path. W. W. H.

For the Journal of the Franklin Institute.

Investigation of the Comparative Merits of the Perpendicular and Radial Paddle Wheels for Sea-Going Vessels. By B. F. Isherwood, Esq., *Chief Engineer, U. S. Navy.*

The perpendicular (sometimes called vibrating) paddle wheel, or paddle wheel whose paddles enter and leave the water perpendicularly, has never been introduced into this country, though extensively used in England and France, both in government and private steamers. The object of this arrangement of the paddles is to avoid the loss of labor by the oblique action of the common radiating paddle wheel. While, however, effecting this object, which is done by the combined movement of an eccentric and a number of jointed levers, it causes another loss of labor from the frictions of the eccentric strap, and the joints of the levers, and this friction amounts to a very considerable per centage, as will readily be appreciated when it is considered that action and reaction being equal, there is sustained by the acting paddles of a paddle wheel the same pressure that is sustained by the steam piston of the engine, which same pressure is sustained also by the various journals transmitting the power of the steam piston to the vessel. The mean of many experiments made to ascertain the friction of metal on metals with lubrication, has been found to be about 10 per cent. of the pressure. But in the case of the steam engine, the pressure is not a *statical* but is a *dynamical* one; that is, it is composed of pressure and the velocity at which the pressure moves; but this product expresses also the power of the engine, wherefore, the friction of the load, that is, of the reaction of the vessel on the journals transmitting the power of the steam piston to the vessel, is one tenth of the power; and, as before stated, action and reaction being equal, the acting paddles sustain this same pressure, and in the perpendicular paddle wheel they turn under this same pressure; wherefore the friction will be as before, one-tenth of this pressure; that is, one-tenth of the total power developed by the engine. That this is correct will be demonstrated from the experimental data hereafter examined. Now, the losses of labor by the common paddle are slip and oblique action, and, as has already been stated, the losses of labor by the perpendicular paddle wheel are slip, and the friction of its moving parts, in addition to which there is a further serious loss by reaction when the horizontal speed of the entering perpen-

dicular paddle is less than the velocity of the vessel, as will be explained hereafter. But slip being entirely dependent upon surface of paddle, it is evident that whatever slip can be given to one wheel can be given to the other, using the proper quantity of paddle surface for that purpose. The comparison is then narrowed down between the loss by oblique action of the radiating paddle wheel, and by friction of its moving parts and reaction of the perpendicular paddle wheel. The loss of labor by the friction of the paddle surface on the water, and by the direct resistance of the paddle edges, may be considered as equal in the two wheels; and is, moreover, too small an absolute quantity to be considered in a general calculation.

The best arrangement of paddle surface for the common radiating paddle wheel, is evidently to make it as long and as narrow as possible, and to make the tip edge of the paddle coincide with the surface of the water. This arrangement for minimum narrowness reduces the slip to the minimum for a given amount of surface, because the slip must be calçulated for the centre of pressure or reaction of the paddle; and it is obvious that the nearer the centre of reaction approaches the outer or lower edge of the paddle, the less will be the displacement or slip; for even if the centre of reaction have no slip, that part of the paddle surface comprised between it and the outer edge of the paddle will operate a displacement.

Making the top edge of the paddle to coincide with the surface of the water, gives the minimum of loss by oblique action; for the less the immersion of the paddle proportionally to the diameter of the wheel, the less will be the vertical composant of the power; because the sine of the angle under which the paddle presses the water vertically will be the less.

But in practice these arrangements are wholly unattainable. In the first place, the length of paddle is restricted by practical considerations; any increase beyond a certain point is accompanied by such decreased strength in the guards, and increased weight in the wheel, as well as by the inconvenience of an excessively broad vessel, (over the guards,) that the paddles of the largest sea-going vessels rarely exceed eleven feet in length. The careening of the vessel also operates a depression of the leeward paddle and a raising of the weather paddle, and, taking the centre of the ship for the centre of oscillation, (not strictly true,) it is evident that this depression and rise is in proportion to the distance between the exterior ends of the paddles of the opposite wheels.

This variation from a horizontal line is injurious to the economical performance of the wheels, with whose normal action it seriously interferes. The length being thus determined, and a certain area of paddle being required to propel with the desired slip, that area must be given by breadth of paddle, which has the twofold disadvantage of requiring deeper immersion to cover the paddle, thereby increasing the loss by oblique action, and of raising the centre of reaction, thereby increasing the slip. It is moreover wholly impossible to make the top edge of the paddle coincide with the water surface, from the varying draughts of water of the steamer from the moment of starting, caused by the consumption of fuel; and from the careening of the vessel, which would, with such an arrangement, lift the weather paddle partly or wholly out of water. It may be taken as a mean with sea-going vessels of medium size, supplied for a voyage of

nine days and over, that the variation of draught by reduction of fuel is about three feet; to this must be added $1\frac{1}{2}$ foot for careening of the vessel and $2\frac{1}{2}$ feet for depth of paddle, and we have for the least mean immersion $\frac{(1\frac{1}{2}+3+2\frac{1}{2})+(2\frac{1}{2}+1\frac{1}{2})}{2}=5\frac{1}{2}$ feet.

Such a proportion of paddle placed on the circumference of a circle of 28 feet diameter, the paddles being about $3\frac{1}{2}$ feet apart, would propel a vessel of 2600 tons displacement and 590 square feet immersed section, with a slip of about 18 per cent., and a loss by oblique action of about $18\frac{1}{3}$ per cent. This loss by oblique action becoming of course less with vessels making shorter voyages, and having proportionally less variations of draught; and also with vessels having wheels of larger diameter, the *absolute* immersion remaining the same. We are again, however, met by difficulties in increasing the diameter of the wheel; in the first place, it requires engines of longer stroke in order to avoid the too great friction caused by the leverage of the centre of reaction of the paddle on the crank pin; and in the second place, the resistance of the wheel houses to the air, the weight of the wheels and housing, &c., are serious disadvantages. In attempting, then, by means of better theoretical proportions for the radial paddle wheel than those now used in practice, to avoid certain losses, we encounter other losses and inconveniences, offsetting or exceeding the gain. It may therefore be considered as settled, that with the ordinary radiating paddle wheel in sea-going vessels of medium size, making voyages of nine days and over, that the loss of labor by slip cannot advantageously be reduced below 20 per cent., nor the loss by oblique action below 18 per cent., making a total of 38 per cent. It is true, however, that the resistance of the water to displacement is greater at greater depths in the proportion of the depths. The greater therefore the immersion of a given paddle, the less will be its slip, but each increase of immersion increases the loss by oblique action, and a point is soon reached where the increased loss by the latter exceeds the increased gain by the former. To push the immersion farther than this is evidently to sustain a greater total loss.

If now, however, the paddles be made to enter, traverse and leave the water perpendicularly, the loss by oblique action is avoided; and if the centre of reaction (which will be as before, one-third the width of the paddle from the outer edge) have no slip, the portion of surface between it and the outer edge of the paddle having the same horizontal velocity, will operate no displacement. Furthermore, by this arrangement, the same absolute paddle surface will propel with less slip than in the radiating paddle, by the difference between the projections of the surfaces horizontally, the perpendicular paddle having its whole surface acting, while the radiating paddle acts but by that surface multiplied by the cosine of the angle under which the paddle strikes the water. For equal slips, then, less absolute propelling surface is required in the perpendicular than in the radiating paddle.

As oblique action is avoided with the perpendicular paddle, and as the losses of labor occasioned by the radiating paddle are slip and oblique action, and as slip is affected by depth of immersion, and as depth of im-

mersion with the radiating paddle is only restricted by the oblique action, —it might be supposed, and has been so supposed by many, that the perpendicular paddle wheel could be immersed advantageously nearly to the axis. This is, however, far from being the case, and for the following reasons:—

With the radiating paddle wheel composed of a number of paddles set around on the periphery *radially*, their propelling efficiency depends on their *horizontal velocity*. Suppose a horizontal line drawn tangential to the lowest point of the periphery of the wheel, and from the centre of pressure of each paddle a perpendicular be let fall upon it, the distances between the intersections will represent relatively the horizontal velocities of the paddles. Now, it is evident that such paddles as have a *less* horizontal velocity than the velocity of the vessel, so far from propelling, carry a mass of water before them; this mass of water, however, occasions no further loss of labor than that due to its friction on the paddle surface and wheel shaft journals, (a very inconsiderable quantity,) because action and reaction being equal and in opposite directions, the reaction of this mass of water on the paddle produces a force acting at right angles to the *radial* paddle, equal to what was communicated to it by the paddle, and this reactionary force at *right angles* to the radii of the wheel turns the wheel, and the turning of the wheel propels the vessel.

But this is not the case with the perpendicular paddle, which forms an angle with the arm or radius at the extremity of which it is set; and the reactionary force of the mass of water carried forward by it being transmitted at right angles to the perpendicular paddle, that is, horizontally, and consequently obliquely to the radius or arm, instead of at right angles to it, as with the radiating paddle, the *whole* of the reactionary force is not applied to turning the wheel, but a resolution of it takes place, and only one composant is applied at right angles to the radii to the turning of the wheel;—the other composant is applied in the direction of the arm or radius, and producing pressure on the shaft in that direction, is absorbed in retarding the advance of the vessel and in lifting it out of water. The proportion of power producing motion in the wheel compared to that lost in retarding the advance of the vessel, and lifting it, will be as the cosine to the sine of the angle under which the arm strikes the water.

It is plain, then, that by increasing the immersion of the perpendicular paddle wheel until the horizontal velocity of the entering paddle is less than the velocity of the vessel, a loss of labor is experienced by part of the reactionary force of the mass of water carried before the paddle being expended in pressure on the shaft, instead of the whole of it being expended, as in the radial paddle wheel in turning the wheel. We therefore reach the economical limit of immersion with the perpendicular paddle, as far as the reactionary force is concerned, when the entering paddle has a *less* horizontal velocity than the velocity of the vessel. To have, then, a deep immersion with the perpendicular paddle wheel without encountering reactionary loss, it must be constructed with such amounts of surface as to give a normal slip for that immersion; that is to say, the immersion will determine the horizontal velocity of the entering paddle, and in order that the velocity of the vessel shall not exceed this, the paddles already in the water, and having from their positions greater horizontal

velocities, must have correspondingly greater slips, in order that none of the reactionary force upon the wheel be lost; but in practice, it will be found proper to ascertain the minimum of all the losses; that is, the minimum of the losses by the deficit of the reactionary force and by the slip of the paddles.

With a paddle wheel of 28 feet extreme diameter and $5\frac{1}{2}$ feet immersion, the slip of the centre of reaction must be about $33\frac{1}{3}$ per cent., in order that there be no loss of reactionary force by the entering paddle; that is to say, in order that the entering paddle carry no mass of water before it. If a slip of about 20 per cent. be given to such a wheel, the immersion must not exceed $3\frac{1}{2}$ feet, in order to fulfil the above requirement. Notwithstanding this, however, the loss of labor by the loss of a portion of the reactionary force, is sufficiently small, with the deep immersions and slips found in practice, to allow a gain by the suppression of the loss by oblique action. Of course, actual experiment or calculation only can determine this amount and the conditions under which equilibrium obtains between the different losses and gains. Independently of the economical results that may arise from the use of the perpendicular paddle, in function of form, there are some important practical advantages connected with its use. The principal one consists in the fact, that a narrower wheel can be used with the same area of paddle, the only limit to the breadth of paddle being the depth of its immersion. In the "Medea," a vessel displacing over 1000 tons, the paddle is 40 inches by 5 feet, because the acting movement of the paddle is wholly horizontal, and the slip is the same for the whole paddle as for its centre of reaction. With such a wheel, the proper proportions of paddle would be the greatest breadth permitted by the immersion; and as this would give an excess of propelling surface, were the usual number of paddles used, as is customary with the radiating paddles, this number can be reduced very considerably; so much so, in truth, that the paddles can be placed at such a distance apart as will allow only so much surface to be always in action as may be necessary to prevent too great irregularities of motion. This distance can be much greater than with the radial paddle, there being no shock vertically on striking the water, as with the radial paddle. The paddles on opposite wheels should of course *break joints*, or alternate with each other, with a view to preserving this regularity of action. The practical advantages may be briefly summed up thus:—The wheel of equal propelling efficiency would have but about two-thirds the weight of the ordinary wheel, and half its width, diminishing the leverage upon the guard timbers and the strain upon the ship. By reason of the greater narrowness, there would be in the rolling of the ship less depression of the leeward and less raising of the weather paddle, with of course less irregularity of motion than with the radiating paddle. By avoiding the oblique action of the radial paddle, a very destructive strain upon the ship is also avoided, for the practical effect of the oblique action of the radiating paddle is to forcibly tear the sides from the bottom of the ship.

Let us consider generally the greatest loss of the reactionary force that will occur with the paddle in its most unfavorable position. That position will evidently be the one occupied by the entering paddle, because the obliquity of the radius of the wheel to the surface of the water is here

greatest. In the deepest immersions this obliquity does not exeeed 45 degrees. Taking it then at 45 degrees, and supposing the paddle in a vertical position at the end of the arm, and supposing the horizontal speed of the paddle less than the speed of the boat: there would be a resolution of the reactionary force upon the arm or radius of the wheel into two equal portions, one of which would be at right angles to the arm, and utilized in producing rotary motion in the wheel; the other would be in the direction of the arm, and produce pressure on the shaft;—at the shaft, a new resolution of this half of the original reactionary force would take place into two equal portions again; one of which, or one quarter of the original reactionary force, would be opposed to the motion of the vessel directly in line of keel; the other, at right to the first, would lift the vessel, and consequently be utilized in decreasing the immersed amidship section and displacement of the vessel. This result, however, is too small to be appreciable in practice, and is proved to be so from the fact that the caps of the outward pillow blocks of the shaft are not pressed down to bear on the top of the shaft journal, but have generally a clear space of half an inch or more left between. Indeed, in many steamers there are no caps at all to these pillow blocks. It is evident now, that with this arrangement, were the action of the lifting force appreciable in raising the vessel, the shaft would be lifted out of its outboard pillow blocks; but observation shows that it has no perceptible lifting at all. The vertical resistance of the water is so small compared with the resistance of the weight of the wheel, shaft, &c., that the power expended vertically, displaces the water instead of lifting the vessel. As far then as practical results are concerned, the lifting force cannot but be considered as lost labor. We find then, that even in the most unfavorable case occurring in practice, the loss with the perpendicular paddle is the sum of the reactionary and lifting forces, which being 25 per cent. each, make a total of 50 per cent.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 18th, 1850.

Samuel V. Merrick, President, in the chair.
Solomon W. Roberts, Corresponding Secretary.
Isaac B. Garrigues, Recording Secretary.
John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters were read from Hon. Abbott Lawrence, Minister at London, and from The Massachusetts Chartiable Mechanics' Association, Boston, Massachusetts.

Donations were received from The Royal Institution of Great Britain; The Statistical Society of London; The Mercantile Library Association of St. Louis, Missouri; The Smithsonian Institution, Washington City, D. C.; Wm. Brady, Esq., U. S. Navy, New York; and Charles E. Smith, Esq., Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Board of Managers and the Standing Committees reported their minutes.

The Treasurer read his statement of receipts and payments for the month of June.

The Board of Managers reported that they had appointed the following Committee to have charge of the School of Design for Women:—Messrs. David S. Brown, Samuel V. Merrick, Frederick Fraley; Mrs. Sarah Peter, Miss Maria Tilghman, Mrs. J. F. Frazer.

New candidates for membership in the Institute (2) were proposed, and those proposed at the last meeting (6) were elected members of the Institute.

On motion, the following resolutions were adopted:

Resolved, That the Franklin Institute approve of the proposal made by the Massachusetts Charitable Mechanics' Association, for the holding of a Convention of Delegates from the different societies devoted to the promotion of the Mechanic Arts and Agriculture, for the purpose of affording facilities to those persons who may wish to have the products of their skill, or other native productions, forwarded to London, to be added to the great Industrial Exhibition of 1851.

Resolved, That the President be authorized to appoint five members to represent the Institute in that Convention.

Resolved, That this Institute recommend that the Convention be held in Philadelphia, and that they hereby tender the use of the Hall of the Institute for its purposes.

Resolved, That in accordance with the request of the Massachusetts Charitable Mechanics' Association, an invitation to join the Convention be forwarded to—

The Philadelphia Society for the Promotion of Agriculture.

The Young Men's Mercantile Library and Mechanics' Institute, Pittsburg, Penna.

The Mechanics' Institute of the City of New York.

The Rochester Athenæum and Mechanics' Institute, Rochester, N. Y.

The Maryland Institute for the Promotion of the Mechanic Arts, Baltimore, Md.

The Mechanics' Association, Columbia, S. C.

The South Carolina Institute, Charleston, S. C.

The Ohio Mechanics' Institute, Cincinnati, Ohio.

The Mechanics' Institute, Chicago, Illinois.

Resolved, That the delegates have power to fill any vacancy in their body, and to extend the invitation to such other societies for the promotion of Mechanics and Agriculture as they may think proper.

On motion, the President's name was directed to be added to the delegation when appointed.

On motion, it was

Resolved, That a memorial from the Institute be presented to Congress, asking that an addition of a Scientific Corps be made to the Commission on the Mexican Boundary Survey.

The Mayor and members of the Corporation of the City and Northern

Liberties, with officers of several Fire Insurance Companies, being present, Mr. G. W. Smith, in allusion to the recent destructive explosion in Water Street, would make a few simple experiments on explosions, with a view to determine whether nitre, under certain conditions, would produce results analogous to those then witnessed.

The first experiment would show that water thrown on fused nitre would cause a violent explosion. [This experiment was omitted on account of the danger attending its performance.] At the recent fire in Brooklyn, large masses of fused nitrate of potassa, and nitrate of soda, were seen flowing in streams; when one of these streams came in contact with the tar or melted rosin, of which large quantities were present, a most violent explosion took place. In the case of an explosion resulting from the contact of water with the fused nitre, it is due to the instantaneous generation of steam, rather than to a chemical decomposition; when, from the mixture of tar or melted rosin with the fused salt, there is probably a distillation of the organic matters and a formation of carburetted hydrogen, which, combining with the oxygen of the saltpetre, proves an explosive compound of great energy.

In the second experiment it was shown that, where 3 parts of nitre, 2 parts of carbonate of potassa, and 1 part of sulphur, are intimately mixed, and exposed to heat on an iron plate, the mixture turns brown, and a violent fulminating explosion takes place. This experiment was varied. In the second portion of it the same proportions were used, but the substances were not mixed; and in the third portion of the experiment a compound of widely different proportions, carelessly mixed, was exposed to the same heat. A melting and ignition of the sulphur was first observed, soon succeeded by vivid combustion, deflagration, occasional crepitations, with several minute explosions, then, after a few seconds' interval, two loud fulminating explosions; thus showing that definite proportions were not absolutely necessary in this compound.

In the third experiment it was shown that, where the materials for gunpowder were mixed in improper proportions, or slightly mixed, no explosion would take place, but a mere deflagration, producing gases which, if confined, might cause an explosion.

In the fourth experiment, a mixture of equal parts of nitre and charcoal alone was found to deflagrate in a similar manner.

Now in the building in question we had a large quantity of hay and straw, with sulphur, nitre, and molasses. Here we have all the elements for the generation of carburetted hydrogen, carbonic oxide, and oxygen, which, if mixed and ignited, would cause a violent explosion. We have also carbon from the hay, straw, and molasses, with burning sulphur and nitre,—all the elements for the production of an explosion.

After the above experiments were performed, portions of Augendre's white powder from chlorate of potassa, gun cotton, and gunpowder, were exploded, to show the relative character of their explosions.

Prof. Frazer, in reply to a request, stated that as he was absent from the city at the time of the accident, and had not even had an opportunity of examining the ruins, he would not, of course, presume to say what was the cause of the explosion. But it must be evident to every one at all familiar with chemical experimentation, that in the conflagration of a

building containing large quantities of nitre, with organic materials, such as hay and molasses, and other combustibles, there were present all the elements necessary for an explosion much more powerful than gunpowder could give rise to. He stated that in the midst of a vast conflagration like this, the want of a sufficient supply of air would cause the organic substances to undergo destructive distillation in place of combustion; and thus a large quantity of inflammable gases would be generated, which, if mixed suddenly with the oxygen from the decomposing nitre, would cause an explosion of the most violent kind.

In support of this view of the method of decomposition of organic substances, he referred to a specimen of glass, now in possession of the Institute, from the great fire at Pittsburg. In this specimen panes of glass have been softened and almost entirely fused by the heat, while they bear upon their surfaces the most delicate impressions of the straw in which they were packed.

To show that an explosion might ensue from such a formation of inflammable gases in presence of oxygen, he also referred to an explosion of an iron smelting furnace, recorded in the "Annales des Mines," January, 1841, (*Journ. Fr. Inst.*, *Vol.* III, 3*d series*, *p.* 163,) caused by an attempt to use baked wood as fuel. In this case a series of explosions ensued by which the whole contents of the furnace were discharged *upwards*. Prof. F. also thought that an amply sufficient cause of the explosions might be found by supposing the melted nitre to fall upon sheets of the water which had been thrown, and was at the time pouring upon the burning building; and in illustration of his point, he stated that he had himself seen a quantity of melted lead accidentally poured into the gutter, at the corner of Minor and Fifth streets, occasioning an explosion by which the lead was thrown to the very tops of the houses. He also referred, for illustration, to the familiar fact of the explosion caused by the casting of iron into damp moulds, and especially to the recent destruction of a furnace near Pittsburg, by the attempt to purify the metal by bringing it, when fused, into contact with water.

Prof. F. also remarked the analogy of this explosion to that which occurred at the great fire in New York in 1845, as described by Dr. Hare, (*Journ. Fr. Inst. Vol.* XV., 3*d series*, *p.* 452,) indicated by the succession of a series of explosions increasing in violence. He also thought that, had gunpowder been in the building in large quantities, the peculiar smell must have been observed by all the witnesses of the accident, and would have been found among the ruins for a long time after the event.

Dr. Turnbull read the following letter from Dr. Wetherill:

"First of all, I hold that, in the explosions at New York, Brooklyn, and Philadelphia, no gunpwder has been proved to be present in sufficient quantity to account for the explosions; we must, in absence of direct experiment, take it for granted that saltpetre will cause explosions under certain conditions; at least this is in the highest degree probable. Any other country, less reckless of life and limb than our own, would have settled this question long ago by direct experiment.

"It remains, I hope, for our own city to institute a course of experiments, not to stop until the matter is settled. Perhaps the best way of doing it would be for the city authorities to appoint a prize for the best essay (with

experiments) on the subject; or else, the Franklin Institute might appoint a committee.

"In the second place, since, in the present state of the science of chemistry, a question like the present cannot be considered as settled without conclusive experiment, all that has been and will be said without experiments will only go to render the one view or the other more or less probable.

"The modes of accounting for the explosion that I have heard are two: 1st, That gunpowder was formed by the union of carbon, sulphur, and nitre. 2d, That of Prof. Rogers, that it was caused by a rapid development of oxygen gas.

"With regard to the first explanation, I think when we consider what great care is required for the preparation of a good powder, in what state of intimate contact must the three constituents be, and that even the granulation plays an important part, I cannot conceive how nitre, fusing and running down into charred molasses, with sulphur, could form an explosive solid (or liquid). Rapid combustion would no doubt ensue, but to my mind deflagration is much more probable than an explosion.

"2d, Nor does Prof. Rogers' explanation satisfy me. We have no experiments to prove that nitre will, under any circumstances, when heated alone, give off all its oxygen at once. A mixture of chlorate of potassa and peroxide of manganese loses oxygen much more readily than nitre, and when a large quantity of the mixture is heated in an iron bottle, and the heat suffered to rise too rapidly, although the gas (which is confined) comes over very quickly, it is in no respect like an explosion; the gas is always given off in successive portions.

"Another explanation which I would modestly submit, and which I do not remember to have seen stated anywhere, but which strikes me as very probable, is that, in all the above explosions, there was a mixture of explosive gases formed which caused the accidents. When a house burns, and especially a warehouse, which is constructed with thick walls and few windows, and when the air has not sufficient oxygen to burn all the carbon to (CO_2) carbonic acid, carbonic oxide is formed,—a gas which explodes violently with oxygen. That the dry distillation of substances stored away may give rise to other gases capable of exploding when mixed with oxygen gas, and that the water thrown in upon the burning materials may give rise to hydrogen gas, is not improbable. Now if we suppose such a mixture of gases to be in the house when the fire reaches the nitre, what may take place? As the nitre melts and gives off oxygen gas, at first slowly, this oxygen unites with a portion of the gases and explodes; then this goes on until the oxygen is evolved 'stormy,' as they say in German, when a large quantity of explosive mixture is formed, and the grand explosion takes place.

"These views are borne out in what took place at the late fire, as Dr. Rand can testify, who was near to the house when the explosion took place. They commenced by small ones, which increased in force until the grand finale. Others stated that the water thrown in upon the fire seemed to determine the explosion. It may be objected to this, that like explosions ought to take place when no nitre is present, explosive mixtures being formed with the oxygen gas of the air; but the cases are, I think,